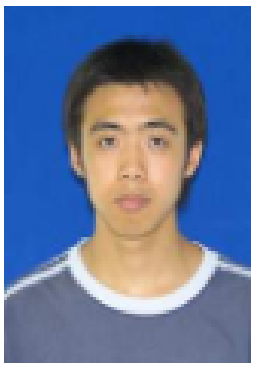
4、 外语能力证书

全国大学英语四级考试(CET4)成绩报告单



姓　　名：曹海波

[redacted]

学　　校：华南农业大学

准考证号：440390072101701

总　　分：**441**

听　　力：**137**

阅　　读：**170**

综　　合：**41**

写作和翻译：**93**

考试时间：2007年12月

成绩报告单编号：072144039002021

5、 学术能力证明材料

主持的部分项目目录

项目（基金）名称	项目来源	金额（万元）	起止年度	排名和主要任务	是否结题	页码
玄武岩纤维增强有机硅改性酚醛模塑料	浙江省经信厅	700.0	2020-2021	排第1，项目负责人，主持项目	是	1-2
环保型无氨酚醛模塑料	浙江省科技厅	150.0	2020	排第1，项目负责人，主持项目	是	3-4
化妆品瓶盖氨基专用料	浙江省科技厅	150.0	2020	排第1，项目负责人，主持项目	是	5-6
环保特种酚醛注塑料	浙江省经信厅	500.0	2022-2023	排第1，项目负责人，主持项目	是	7-8
环保型低收缩苯并噁嗪-酚醛模塑料	浙江省经信厅	150.0	2021	排第2，项目技术负责人，主持项目	是	9-10
电子电器用高性能氨基（密胺）复合材料（模塑料）	浙江省经信厅	360.0	2022-2023	排第2，项目技术负责人，主持项目	是	11-12
地铁疏散平台用生物质酚醛复合材料	四川省科技厅	660.0	2017-2019	排第1，项目负责人，主持项目	是	13-14
年产3000吨生物质酚醛复合材料	眉山市科技局	500.0	2016-2019	排第1，项目技术负责人，主持项目	是	15-16
精密仪器仪表用环保无氨型特种酚醛注塑料	衢州市科技局重点攻关项目	500.0	2022-2023	排第1，项目负责人，主持项目	否	17-18
石墨烯改性自润滑热固性聚酯树脂的研制及其特种注塑料工艺的研究	衢州市科技局重点攻关项目	300.0	2023-2024	排第2，项目技术负责人，主持项目	否	19-20
高性能玻纤密胺模塑料的研发	开化县经信局	100.0	2020	排第2，项目技术负责人，主持项目	是	21-22
纤维素纳米晶须改性密胺模塑料的研究	开化县经信局	100.0	2021	排第1，项目负责人，主持项目	是	23-24
高效利用废弃酚醛塑料制品制备无氨酚醛注塑料的研究	开化县经信局	150.0	2023	排第1，项目负责人，主持项目	是	25-26
高强度氨基模塑料的研究开发	开化县经信局	150.0	2019-2020	排第1，项目负责人，主持项目	是	

部分发明专利目录

专利名称	专利类别	专利号	批准时间	本人排名	是否授权	是否投产	页码
一种结构件用高性能氨基模塑料及其制备方法	发明专利	ZL202310156689.6	2023	1	是	是	27
苯并噁嗪树脂和酚醛树脂的共聚树脂的制备方法及用其制备苯并噁嗪-酚醛模塑料	发明专利	CN202111156847.5	2024	1	是	是	27
一种纤维增强的生物树脂胶复合材料及其制备方法	发明专利	ZL201610791868.7	2018	1	是	是	27
一种适用于热固性树脂改性的生物质油及其制备方法	发明专利	ZL201610378510.1	2018	1	是	是	28
一种用作环氧树脂固化剂的含磷线型酚醛树脂及其制备方法	发明专利	ZL201610783531.1	2018	1	是	是	28
一种生物质油改性环氧树脂及其制备方法	发明专利	ZL201610783511.4	2018	1	是	是	28
一种生物质油改性环氧树脂防腐涂料及其制备方法	发明专利	ZL201610786147.7	2018	1	是	是	29
一种快固化型生物质油改性酚醛树脂及其制备方法	发明专利	ZL201610791962.2	2018	1	是	是	29
一种利用废弃泡沫制备的防火板材及其制备工艺	发明专利	ZL201410362056.1	2017	1	是	否	29
干式一步法制备玻璃纤维改性氨基模塑料	发明专利	CN2021 1158566 0.7	2021	1	否	是	
纤维素纳米晶须增强改性密胺模塑料的制备方法	发明专利	CN202110826158.4	2021	1	否	是	
高效利用废弃酚醛模塑料制品制备无氨酚醛注塑料的方法	发明专利	CN2022116521 56.9	2022	1	否	是	
一种酚醛模塑料的湿法造粒反应釜	发明专利	CN2022116671 25.0	2022	1	否	是	
低残碳酚醛树脂及其高耐漏电起痕指数模塑料的制备	发明专利	CN202211714415.6	2022	1	否	是	
一种特种环保无氨酚醛注塑料一步法制备工艺	发明专利	CN2023102704 49.9	2023	1	否	是	
竹纤维增强有机硅改性热固性氨基复合材料及其制备	发明专利	CN202311585136.9	2023	1	否	否	

浙江省经济和信息化厅文件

浙经信技术〔2020〕136号

关于印发2020年浙江省重点技术创新项目和重点高新技术产品开发项目的通知

各市、县（市、区）经信局：

为贯彻落实《浙江省实施制造业产业基础再造和产业链提升工程行动方案（2020-2025）》，全面实施创新驱动发展战略，提高企业创新能力，经企业申报、地方推荐，专家审核，确定浙江亚太智能网联汽车创新中心有限公司的“分布式驱动自动驾驶平台研发”等135个项目列入《2020年浙江省重点技术创新项目》（附件1）、万向一二三股份公司的“MEB78AH高性能电池产品”等120个项目列入《2020年浙江省重点高新技术产品开发项目》（附件2）。现将项目计划印发给你们，请加大支持力度，并加强对项目实施的督促、管理，确保企业按时高质完成项目。

附件：1.2020年浙江省重点技术创新项目计划

2.2020年浙江省重点高新技术产品开发项目计划

浙江省经济和信息化厅

2020年10月16日

98	玄武岩纤维增强有机硅改性酚醛模塑料	1、弯曲强度σfm≥180MPa； 2、简支梁冲击强度 acu≥20KJ/m2； 3、简支梁缺口冲击强度≥4.0KJ/m2； 4、表面电阻≥1×10∧11Ω； 5、体积电阻≥1×10∧12Ω.cm； 6、负荷变性温度Tff 1.8 ≥210℃； 7、耐漏电起痕指数PTI≥175； 8、阻燃性达到UL94 V0级。	开化瑞达塑胶科技有限公司	浙江大学	2020-01-01至2021-12-31	开化县
99	防眩光纹理保护屏	1、高强度（强化）CS >850MPa，DOL>45um，落球标准：高度82.5cm，5点3次不破； 2、印刷刻度：纹理（线宽0.08*0.1mm）； 3、钢丝网外圈纹理同心度（≤0.08mm）线宽（0.08mm）线距（0.10mm）； 4、耐摩擦：橡皮擦厚擦5000次，摩擦后>100，水接触角：115±5°硬度：9H，750g； 5、炫彩NCVM镀膜炫彩颜色要求：0<a<8-14<。	浙江星星科技股份有限公司	/	2019-10-01至2020-12-31	柯江区
100	新型抗凝血药替格瑞洛	1、构建具有高效不对称环丙烷化的细胞色素P450酶，生产(1R,2S)-2-(3,4-二氟苯基)环丙甲酸乙酯产率大于80%,非对映选择性d.e.大于95%,e.e.值大于99.0%,得到了合成(1R,2S)-2-(3,4-二氟苯基)环丙胺的关键中间体。 2、比旋度-52°～-57°； 3、炽灼残渣：≤0.1% 4、重金属：≤20ppm 5、对映异构体：≤0.15% 6、(1R,2S)-2-(3,4-二氟苯基)环丙胺：≤8ppm 7、未知杂质：≤0.10% 8、总杂质：≤1.0%	浙江乐普药业股份有限公司	华东理工大学	2019-10-01至2021-12-31	柯江区

鉴定（验收）意见

2022年01月11日，开化县经济和信息化局在杭州主持召开了由开化瑞达塑胶科技有限公司承担的"玄武岩纤维增强有机硅改性酚醛模塑料"省级工业新产品鉴定（验收）会，鉴定（验收）委员会听取了承担单位的工作总结、技术总结、产品检测、科技查新等报告，审查了有关材料。经讨论，形成如下意见：

1、提供的资料基本齐全、规范、符合鉴定要求。

2、项目产品以酚醛树脂为基料，采用自主开发的含有多种活性基团的低分子量有机硅树脂对玄武岩纤维进行表面改性，添加固化剂、固化促进剂、无机填料、润滑剂和脱膜剂等，经复式单螺杆挤出机混炼挤出、压片、粉碎造粒等工序制得。产品具有拉伸强度高、冲击性能好等特点，广泛应用于汽车、航天工业等领域关键部件的生产。产品在玄武岩纤维表面改性技术上有创新，申请发明专利1件，授权实用新型专利2件，技术处国内同类产品领先水平。

3、产品经通标标准技术服务有限公司苏州分公司检测（SUIN2109007993MR-01_CN），所测结果符合GB/T 1404.3-2008《塑料 粉状酚醛模塑料第3部分：选定模塑料的要求》国家标准和备案通知书要求；产品经用户使用，反映良好。

4、企业已通过GB/T 19001-2016质量管理体系认证和GB/T 24001-2016环境管理体系认证，生产设备、检测手段齐全，污染物排放达到环保要求，具备工业化生产条件。

鉴定（验收）委员会认为，该产品的开发是成功的，同意通过鉴定（验收）。

鉴定（验收）委员会主任：

副主任：

2022年01月11日

开化瑞达塑胶科技有限公司
新产品开发立项审批备案表

新产品/项目名称	玄武岩纤维增强有机硅改性酚醛模塑料	项目编号	R020200101
经费预算	700万元	起止时间	2020.1—2021.12
项目成员	曹海波 方兵华 程国俊 韩明吉 杨立根 陈一军 郭崇旭 薛紫琴		

一、立项目的和意义：

本课题研究范畴集中于酚醛模塑料，酚醛树脂作为最早实现工业化生产的合成树脂，生产成本低廉，机械性能优良，其较高的体积电阻率适用于绝缘材料行业，成本远低于目前作为绝缘材料主要成分的环氧树脂，因而具有巨大的性能改进余地。其阻燃性能远优于环氧树脂，但是其电气性能（介电行为等）以及加工性能由于高密度刚性苯环的存在，不如环氧体系。通过官能化的有机硅低聚物能够克服酚醛树脂的以上缺陷，使之趋近于环氧树脂基体，同时还可以提高酚醛树脂的耐热性和耐候等，于此同时其制造加工成本远低于环氧体系。另一方面，玄武岩纤维是一种新型无机环保绿色高性能纤维材料，它是由二氧化硅、氧化铝、氧化钙、氧化镁、氧化铁和二氧化钛等氧化物组成。玄武岩纤维不仅强度高，而且还具有电绝缘、耐腐蚀、耐高温等多种优异性能。此外，玄武岩纤维的生产工艺决定了产生的废弃物少，对环境污染小，且产品废弃后可直接在环境中降解，无任何危害，因此是一种名副其实的绿色、环保材料。我国已把玄武岩纤维列为重点发展的四大纤维（碳纤维、芳纶、超高分子量聚乙烯、玄武岩纤维）之一，是我国"十三五"战略性新兴产业重点产品。浙江省也把玄武岩纤维及其复合材料制品作为省重大新产品列入省关键技术攻关目录。与玻璃纤维相比，玄武岩纤维有更高抗拉强度和更高的弹性模量以及更高的使用温度，但由于玄武岩纤维与树脂基体的结合力和相容性较差，使得玄武岩纤维在复合材料领域受到了极大的限制，传统的工艺是使用偶联剂类的浸润剂对玄武岩纤维的表面进行处理，以增加与树脂基体的粘结力和相容性，但长期以来并没有取得突破性的进展。

本课题创新性的采用低分子量的有机硅树脂对玄武岩纤维表面进行包覆处理，用于增强有机硅改性的酚醛树脂已制备高性能的模塑料，使模塑料的综合性能达到或超过环氧模塑料，同时成本低于环氧模塑料，应用于汽车、飞行器、船舶、智能设备等高端领域的零部件制造。

浙江省科学技术厅

请输入搜索关键词

浙江省科学技术厅
关于2020年省级新产品试制计划（第二批）拟立项项目的公示

发布日期：2021-01-06 11:46 浏览次数：5641次

根据《浙江省科学技术厅关于下放省级新产品试制计划评审权限有关事项的通知》（浙科发规〔2020〕51号），经各设区市科技局组织评审和推荐立项，经我厅研究，现将拟列入浙江省2020年新产品试制计划（第二批）的8929项项目名单予以公示,公示期为7天。对公示内容有异议的，请于公示期内向我厅以实名、书面等形式提出。异议需提供事实证据。对收到的异议，我厅将按照相关规定办理。

联系人：浙江省科技厅规划处 郑寅 0571-87054006

联系地址:杭州市环城西路33号 邮编：310006

附件: 2020年省级新产品试制计划（第二批）拟立项项目公示名单.xlsx

浙江省科学技术厅

2021年1月6日

7352	7350	2020D60SA947927	双螺旋芯灯灯条的研发	浙江九阳光电有限公司	江山市科学技术局
7353	7351	2020D60SA968591	高显色低光衰指数灯	浙江安安照明有限公司	开化县科技局
7354	7352	2020D60SA9112589	环保型汽车发动机节能减排机油及植物机滤芯	衢州护驹汽车科技有限公司	柯城区科技局
7355	7353	2020D60SA9211748	汽车内饰专用胶7070L	衢州市富星和宝黏胶工业有限公司	衢江区科技局
7356	7354	2020D60SA9211750	特种结构胶4030E	衢州市富星和宝黏胶工业有限公司	衢江区科技局
7357	7355	2020D60SA9214430	高稳定性阳离子杀菌剂及其制备方法	浙江百斯特化工有限公司	衢江区科技局
7358	7356	2020D60SA9214893	氟硅纳米防水隔热防腐涂料	衢州市闻天化工有限公司	衢江区科技局
7359	7357	2020D60SA9219662	脱硫废水去氨氮及循环利用技术	衢州东港环保热电有限公司	衢江区科技局
7360	7358	2020D60SA9220264	基于区域集中集约化制冷供热技术	衢州东港环保热电有限公司	衢江区科技局
7361	7359	2020D60SA929813	低毒性微生物抑制剂及其制备方法	浙江百斯特化工有限公司	衢江区科技局
7362	7360	2020D60SA929814	高稳定性阳离子湿强剂及其制备方法	浙江百斯特化工有限公司	衢江区科技局
7363	7361	2020D60SA9312578	聚氨酯导电涂料	浙江纳宝莱化工科技有限公司	龙游县科技局
7364	7362	2020D60SA965539	基于多功能废矿物油预处理技术的燃料油	浙江海宇润滑油有限公司	开化县科技局
7365	7363	2020D60SA965590	新型环保易涂胶快速固化地毯草坪专用胶	衢州市东凯胶业有限公司	开化县科技局
7366	7364	2020D60SA967060	化妆品瓶盖氨基专用料	开化瑞达塑胶科技有限公司	开化县科技局
7367	7365	2020D60SA967061	环保型无氨酚醛模塑料	开化瑞达塑胶科技有限公司	开化县科技局
7368	7366	2020D60SA9010977	玉米纤维与羊毛混纺纱（70%玉米纤维/30%羊毛混纺28ex）	常山县隆盛线业有限公司	常山县科技局
7369	7367	2020D60SA9010978	竹纤维素纤维与多种纤维混纺纱（50%竹纤维/40%天丝/10%绢丝25.7tex）	常山县隆盛线业有限公司	常山县科技局
7370	7368	2020D60SA9021163	适用于高速压贴的新型装饰纸（胡桃木14-20003-193）	浙江夏特新材料有限公司	衢州市科技局
7371	7369	2020D60SA904538	鱼纹渐变纱线	浙江卡罗莱纳纺织有限公司	常山县科技局
7372	7370	2020D60SA904539	太极石多功能纱线(H165R 50S)	浙江卡罗莱纳纺织有限公司	常山县科技局
7373	7371	2020D60SA905040	羊毛抗菌导电纱（黑色 32支）	浙江常山康辉纺织有限公司	常山县科技局
7374	7372	2020D60SA906501	高强度高透明度描图纸	浙江五星纸业有限公司	衢州市科技局
7375	7373	2020D60SA908216	高营养功能性山茶油	常山富而康山茶油有限公司	常山县科技局
7376	7374	2020D60SA909514	UV发泡壁纸	浙江爱丽莎环保科技有限公司	常山县科技局

鉴 定 意 见

浙江联政科技评估中心于2020年7月2日在杭州组织召开了由开化瑞达塑胶科技有限公司研制的"环保型无氨酚醛模塑料"新产品鉴定会。鉴定委员会听取了工作总结、技术总结、用户使用等报告，审查了相关资料，经讨论与质询，形成以下鉴定意见：

1、提供鉴定的文件资料基本齐全、规范，符合鉴定要求。

2、产品采用热固性酚醛树脂与热塑性酚醛树脂复配，开发了环保固化体系，降低了游离氨残留；采用无碱短切玻璃纤维和粉状无机矿物组成的混合填料，提高了耐热抗冲和绝缘性能；设计了酚醛树脂生产自动化控制设备，实现原料配比自动计量加料，降低了劳动强度，提高了生产效率。产品在配方工艺和生产设备上有创新，相关技术处于国内同类产品领先水平。

3、产品经机械工业电工材料产品质量监督检测中心检测，所测指标符合相关标准要求，经用户使用，反映良好，有较好的经济和社会效益。

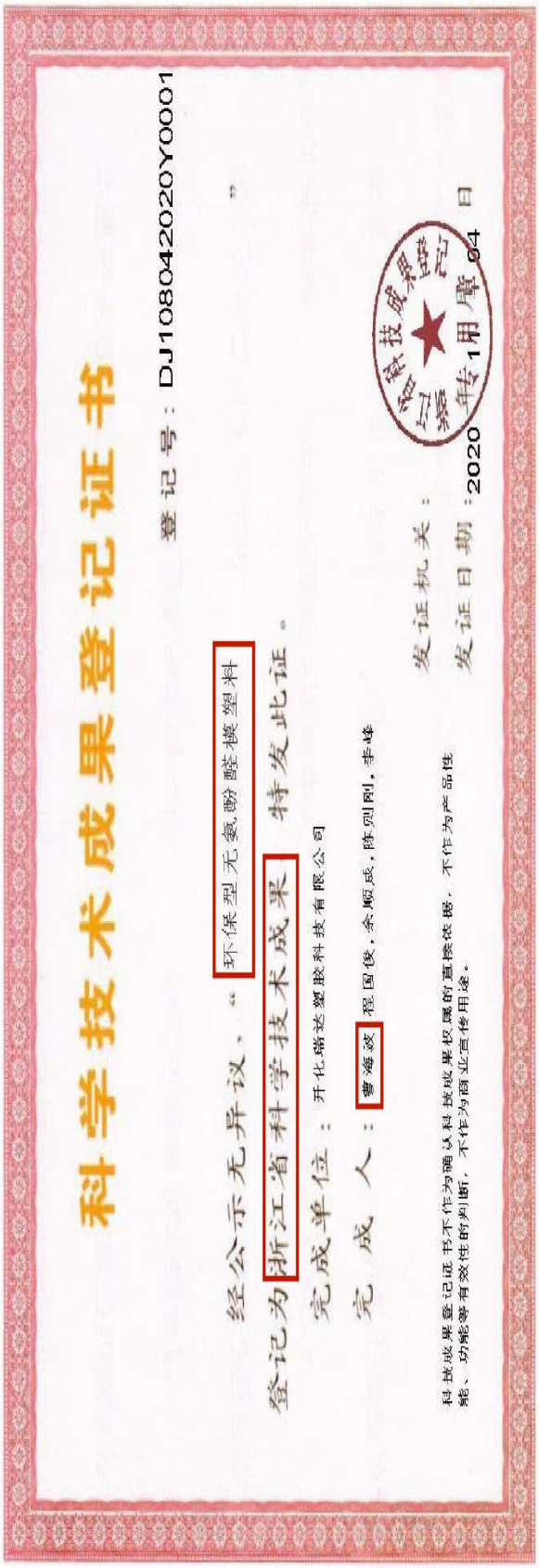
4、企业已通过ISO9001:2008质量管理体系认证，其生产设备、检测手段能满足批量生产要求。

鉴定委员会认为，该产品的研制是成功的，同意通过鉴定。

鉴定委员会主任：

副主任：

2020年7月2日



浙江省科技厅制

科学技术成果登记证书

登记号：DJ1080420200Y0001

经公示无异议，"环保型无氨酚醛模塑料"登记为浙江省科学技术成果，特发此证。

完成单位：开化瑞达塑胶科技有限公司

完 成 人：曹海波，程国俊，余顺成，陈剑刚，李峰

发证机关：

发证日期：2020年11月04日

科技成果登记证书不作为确认科技成果权属的直接依据，不作为产品性能、功能等有效性的判断，不作为商业宣传用途。

浙江省科学技术厅

请输入搜索关键词

浙江省科学技术厅
关于2020年省级新产品试制计划（第二批）拟立项项目的公示

发布日期：2021-01-06 11:46 浏览次数：5641次

根据《浙江省科学技术厅关于下放省级新产品试制计划评审权限有关事项的通知》（浙科发规〔2020〕51号），经各设区市科技局组织评审和推荐立项，经我厅研究，现将拟列入浙江省2020年新产品试制计划（第二批）的8929项项目名单予以公示,公示期为7天。对公示内容有异议的，请于公示期内向我厅以实名、书面等形式提出。异议需提供事实证据。对收到的异议，我厅将按照相关规定办理。

联系人：浙江省科技厅规划处 郑寅 0571-87054006

联系地址:杭州市环城西路33号 邮编：310006

附件: 2020年省级新产品试制计划（第二批）拟立项项目公示名单.xlsx

浙江省科学技术厅

2021年1月6日

7352	7350	2020D60SA947927	双螺旋芯灯灯条的研发	浙江九阳光电有限公司	江山市科学技术局
7353	7351	2020D60SA968591	高显色低光衰指数灯	浙江安安照明有限公司	开化县科技局
7354	7352	2020D60SA9112589	环保型汽车发动机节能减排机油及植物机滤芯	衢州护驹汽车科技有限公司	柯城区科技局
7355	7353	2020D60SA9211748	汽车内饰专用胶7070L	衢州市富星和宝黏胶工业有限公司	衢江区科技局
7356	7354	2020D60SA9211750	特种结构胶4030E	衢州市富星和宝黏胶工业有限公司	衢江区科技局
7357	7355	2020D60SA9214430	高稳定性阳离子杀菌剂及其制备方法	浙江百斯特化工有限公司	衢江区科技局
7358	7356	2020D60SA9214893	氟硅纳米防水隔热防腐涂料	衢州市闻天化工有限公司	衢江区科技局
7359	7357	2020D60SA9219662	脱硫废水去氨氮及循环利用技术	衢州东港环保热电有限公司	衢江区科技局
7360	7358	2020D60SA9220264	基于区域集中集约化制冷供热技术	衢州东港环保热电有限公司	衢江区科技局
7361	7359	2020D60SA929813	低毒性微生物抑制剂及其制备方法	浙江百斯特化工有限公司	衢江区科技局
7362	7360	2020D60SA929814	高稳定性阳离子湿强剂及其制备方法	浙江百斯特化工有限公司	衢江区科技局
7363	7361	2020D60SA9312578	聚氨酯导电涂料	浙江纳宝莱化工科技有限公司	龙游县科技局
7364	7362	2020D60SA965539	基于多功能废矿物油预处理技术的燃料油	浙江海宇润滑油有限公司	开化县科技局
7365	7363	2020D60SA965590	新型环保易冰胶快速固化地毯草坪专用胶	衢州市东凯胶业有限公司	开化县科技局
7366	7364	2020D60SA967060	化妆品瓶盖氨基专用料	开化瑞达塑胶科技有限公司	开化县科技局
7367	7365	2020D60SA967061	环保型无氨酚醛模塑料	开化瑞达塑胶科技有限公司	开化县科技局
7368	7366	2020D60SA9010977	玉米纤维与羊毛混纺纱（70%玉米纤维/30%羊毛混纺28ex）	常山县隆盛线业有限公司	常山县科技局
7369	7367	2020D60SA9010978	竹纤维素纤维与多种纤维混纺纱（50%竹纤维/40%天丝/10%绢丝25.7tex）	常山县隆盛线业有限公司	常山县科技局
7370	7368	2020D60SA9021163	适用于高速压贴的新型装饰纸（胡桃木14-20003-193）	浙江夏特新材料有限公司	衢州市科技局
7371	7369	2020D60SA904538	鱼纹渐变纱线	浙江卡罗莱纳纺织有限公司	常山县科技局
7372	7370	2020D60SA904539	太极石多功能纱线(H165R 50S)	浙江卡罗莱纳纺织有限公司	常山县科技局
7373	7371	2020D60SA905040	羊毛抗菌导电纱（黑色 32支）	浙江常山康辉纺织有限公司	常山县科技局
7374	7372	2020D60SA906501	高强度高透明度描图纸	浙江五星纸业有限公司	衢州市科技局
7375	7373	2020D60SA908216	高营养功能性山茶油	常山富而康山茶油有限公司	常山县科技局
7376	7374	2020D60SA909514	UV发泡壁纸	浙江爱丽莎环保科技有限公司	常山县科技局

鉴　定　意　见

浙江联政科技评估中心于2020年5月17日在杭州组织召开了由开化瑞达塑胶科技有限公司研制的“化妆品瓶盖氨基专用料”新产品鉴定会。鉴定委员会听取了工作总结、技术总结、用户使用等报告，审查了相关资料，查看了样品，经讨论与质询，形成以下鉴定意见：

1、提供鉴定的文件资料基本齐全、规范，符合鉴定要求。

2、本项目优化了物料配方，采用预热和分段升温工艺、合理设置排气以及温度精确测控等新技术，提高了颜色质地、色泽均匀度和硬度；自主设计了新型球磨机，防止粉尘污染。产品在配方工艺和生产设备上有创新，相关技术处于国内同类产品领先水平。

3、产品经通标标准技术服务（上海）有限公司检测，所测指标符合相关标准要求，经用户使用，反映良好，有较好的经济和社会效益。

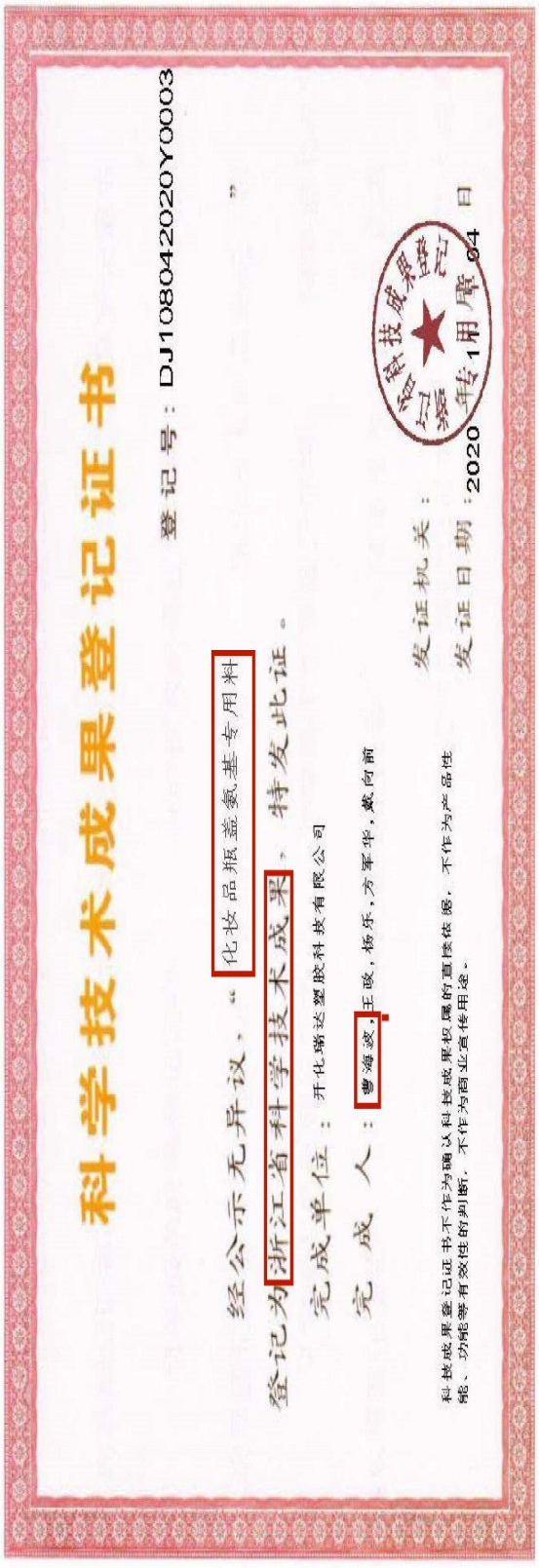
4、企业已通过ISO9001:2015质量管理体系认证，其生产设备、检测手段能满足批量生产要求。

鉴定委员会认为，该产品的研制是成功的，同意通过鉴定。

鉴定委员会主任：

副主任：

2020年5月17日



科学技术成果登记证书

登记号：DJ1080420200Y0003

经公示无异议，“化妆品瓶盖氨基专用料”，特发此证。

登记为浙江省科学技术成果。

完成单位：开化瑞达塑胶科技有限公司

完 成 人：曹海波，王晓，杨乐，方军华，戴向前

发证机关：浙江省科技厅制

发证日期：2020年1月第04号

科技成果登记证书不作为确认科技成果权属的直接依据，不作为产品性能、功能等有效性的判断，不作为商业宣传用途。

浙江省省级工业新产品开发立项通知书

开化瑞达塑胶科技有限公司：

你公司申报的环保型特种酚醛注塑料，经审核同意列入2023年度省级工业新产品开发立项计划，请你单位接到立项通知书后，抓紧实施，并于2023年08月31日前完成开发，原则上开发完成后一年内开展验收评价。

立项编号： 202304A01281

环保型特种酚醛注塑料技术指标见附件。

浙江省经济和信息化厂

2023年04月17日

INDUSTRIAL INNOVATION

浙江省工业新产品证书

证书编号：202304A01281-20231203-04627

★★★★★

产品名称：环保型特种酚醛注塑料

企业名称：开化瑞达塑胶科技有限公司

研发人员：曹海波 杨国华 方兵华 程友良 程国俊 杨乐 王政 陈一军 郭崇旭

浙江省经济和信息化厂

2023年12月22日

浙江省省级工业新产品开发立项通知书

开化瑞达塑胶科技有限公司：

你公司申报的**电子电器用新型高性能氨基（密胺）复合材料（模塑料）**，经审核同意列入2023年度省级工业新产品开发立项计划，请你单位接到立项通知书后，抓紧实施，并于2023年06月30日 前完成开发，原则上开发完成后一年内开展验收评价。

立项编号： 202304A01282

电子电器用新型高性能氨基（密胺）复合材料（模塑料）技术指标见附件。

浙江省经济和信息化厅

2023年04月17日

INDUSTRIAL INNOVATION

浙江省工业新产品证书

证书编号：202304A01282-20231203-04626

★★★★★

产品名称：电子电器用新型高性能氨基（密胺）复合材料（模塑料）

企业名称：开化瑞达塑胶科技有限公司

研发人员：方兵华 曹海波 程友良 韩明吉 程国俊 陈一军 郭崇旭 郭奉将 王政

浙江省经济和信息化厅

2023年12月22日

开化县科技创新服务中心

关于组织2023年度县科技计划项目评审验收的通知

各项目承担单位：

根据《开化县科技计划项目与经费管理办法》（开经信〔2019〕70号）、《开化县科技计划项目与经费管理办法若干补充》（开经信〔2020〕99号）有关规定，经研究，决定对2023年度县科技计划项目进行评审验收。现将有关事项通知如下：

一、评审验收范围

2023年度县级科技计划（工业、农业领域类）（清单见附件1）。

二、评审验收流程

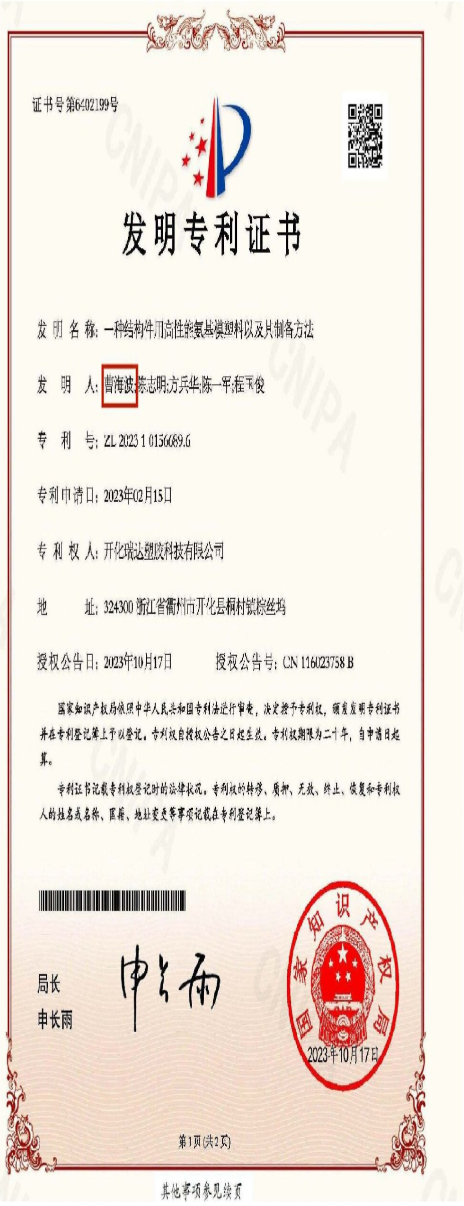
1.开展财务审计：10月15日至26日，我局将委托第三方机构对所有项目经费使用情况进行统一审计，出具的审计报告将作为验收的重要依据；

2.提交验收材料：10月27日前，各项目承担单位根据本通知要求，提交项目验收材料；

附件1

2023年度开化县科技计划项目清单（工业、农业领域）

序号	项目名称	承担单位	支持方式
工业领域项目			
1	高品质硅片有蜡抛光技术的研发与应用	浙江挺盛电子有限公司	事后补助
2	高效利用废弃酚醛塑料制品制备无氨酚醛注塑料的研究	开化瑞达塑胶科技有限公司	事后补助
3	甲基三甲氧基硅烷中和工序优化技术研究	浙江开化合成材料有限公司	事后补助
4	“一二次深度融合”智能真空断路器及组合电器开发	浙江省开化七一电力器材有限责任公司	事后补助
5	PVA炉18英寸热场5-6英寸重掺锑衬单晶的研究与开发项目	浙江海纳半导体股份有限公司	事后补助
6	绿色天然冰片提取精制工艺及方法的研究	浙江正荣香料有限公司	事后补助
7	马来松香丙烯酸酯树脂的研究与开发	开化诚信树脂有限公司	事后补助
8	橡胶混炼工艺优化研究	开化华胜制鞋有限公司	事后补助
9	环保水性快干油条铅笔添的研发与应用	浙江振东文具有限公司	事后补助
10	管肩和帽盖一体注塑成型的密封包装软管的研发	浙江万巨包装科技有限公司	事后补助
11	彩色卡册自动化精细覆膜技术的研究	衢州奇彩文体用品有限公司	事后补助
12	注塑式防护圈溶垦纯研究开发	浙江恩纬新材料科技有限公司	事后补助
13	生物技术运用领域高端塑制耗材的技术研究与运用	浙江爱津生物技术有限公司	事后补助
14	赤藓糖醇发酵工艺放大关键因素研究	浙江华康药业股份有限公司	事后补助
农业领域项目			
1	一种针形茶揉青工艺新技术	浙江云翠茶业发展有限公司	事后补助
2	不同种植模式对钱江源铁皮石斛的品质影响与评价	浙江森古生物科技有限公司	事后补助



证书号第6402199号

发明专利证书

发 明 名 称：一种结构件用高性能氨基模塑料以及其制备方法

发 明 人：曹海波;陈志明;方兵华;陈一平;程丽俊

专 利 号：ZL 2023 1 0156689.6

专利申请日：2023年02月15日

专 利 权 人：开化瑞达塑胶科技有限公司

地 址：324300 浙江省衢州市开化县桐村镇棕丝坞

授权公告日：2023年10月17日　　授权公告号：CN 116023758 B

国家知识产权局依照中华人民共和国专利法进行审查，决定授予专利权，颁发发明专利证书并在专利登记簿上予以登记。专利权自授权公告之日起生效。专利权期限为二十年，自申请日起算。

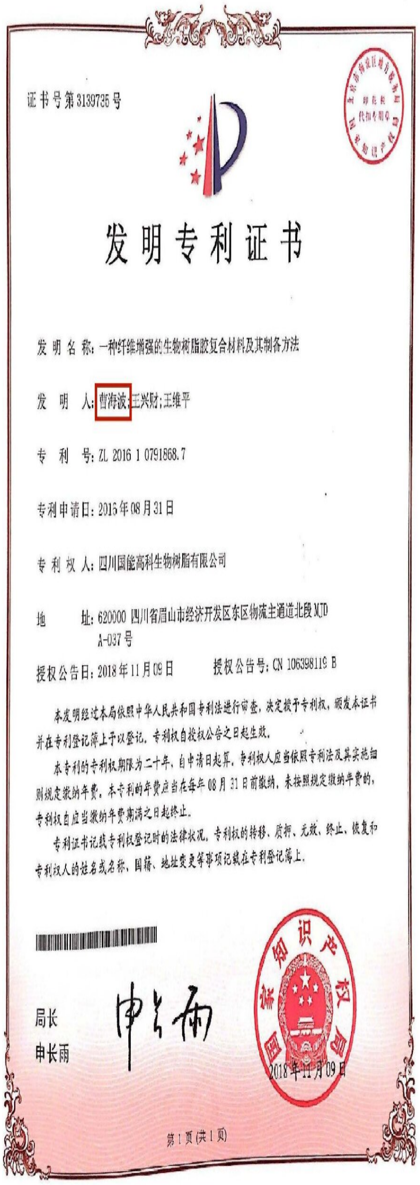
专利证书记载专利权登记时的法律状况。专利权的转移、质押、无效、终止、恢复和专利权人的姓名或名称、国籍、地址变更等事项记载在专利登记簿上。

局长
申长雨

2023年10月17日

第1页(共2页)

其他事项参见续页



证书号第3139735号

发明专利证书

发 明 名 称：一种纤维增强的生物树脂胶复合材料及其制备方法

发 明 人：曹海波;王兴财;王维平

专 利 号：ZL 2016 1 0791868.7

专利申请日：2016年08月31日

专 利 权 人：四川国能高科生物树脂有限公司

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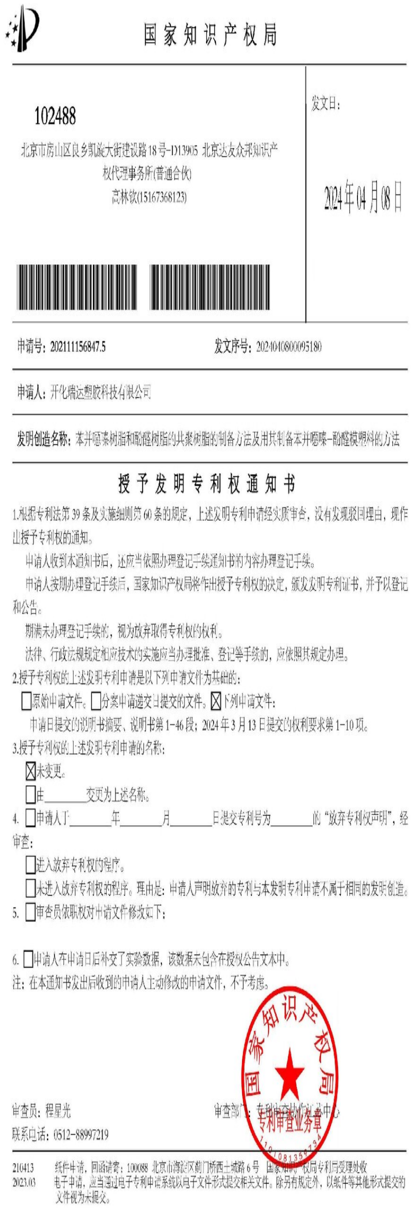

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申请人：开化瑞达塑胶科技有限公司

发明创造名称：苯并噁嗪树脂和酚醛树脂的共聚树脂的制备方法及用其制备苯并噁嗪-酚醛模塑料的方法

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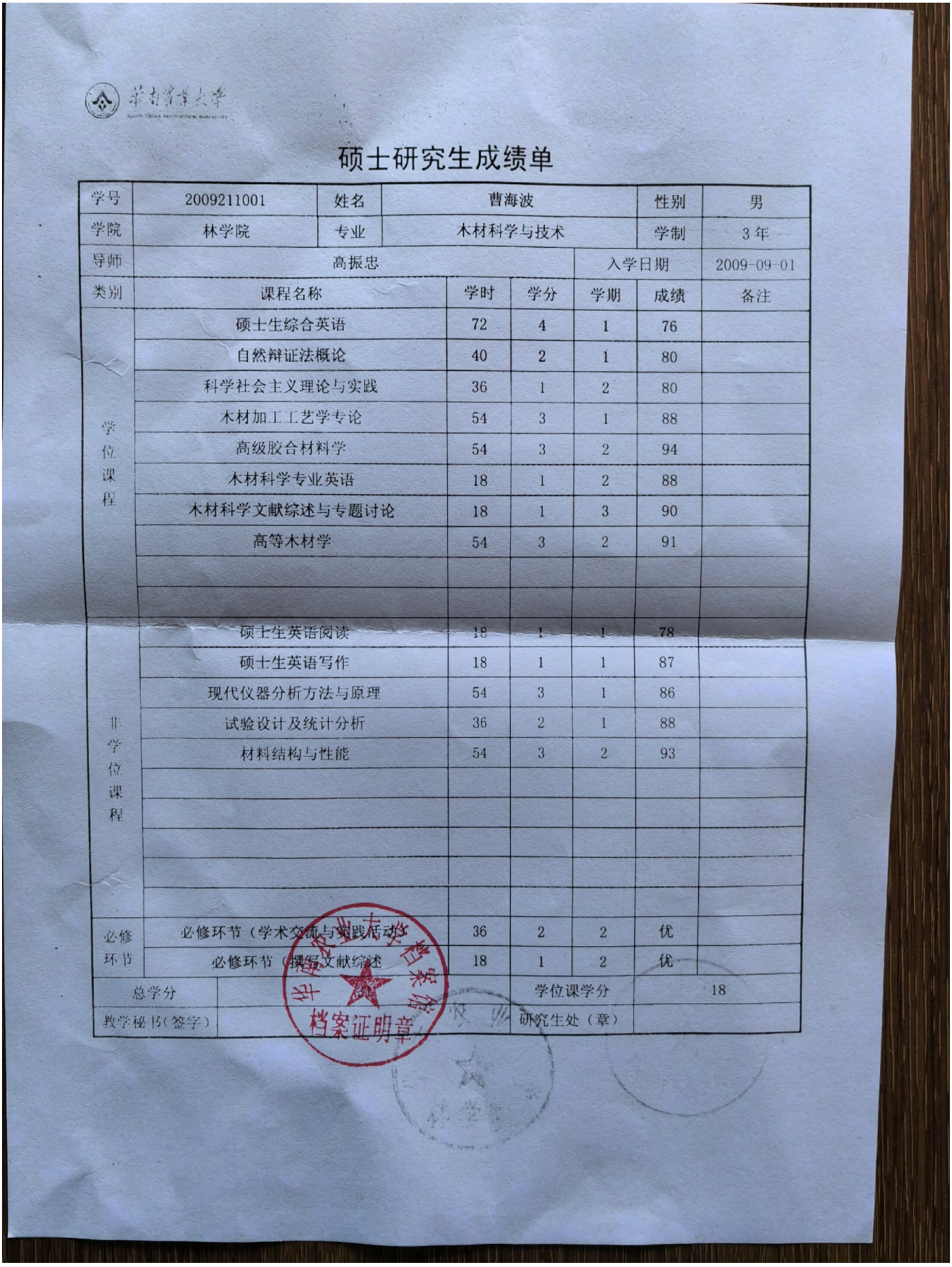

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	自然辩证法概论		40	2	1	80	
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	硕士生英语写作		18	1	1	87	
	现代仪器分析方法与原理		54	3	1	86	
	试验设计及统计分析		36	2	1	88	
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Advanced Composites and Hybrid Materials
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ORIGINAL RESEARCH

Fluorescent probe of nitrogen-doped carbon dots derived from biomass for the sensing of MnO_4^- in polluted water based on inner filter effect

Wenjing Chen[1] · Hong Lin[2] · Yunqing Wu[1] · Meng Yang[1] · Xiangling Zhang[1] · Shihua Zhu[1] · Wanning He[1] · Ranxin Xie[1] · Zhongjun Shi[2]

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Abstract
Nitrogen-doped carbon dots (N-CDs) were prepared from *Acer saccharum* marsh (L.ex Blonk.) Ostenf via a one-step hydrothermal method. The N-CDs were spherical with an average particle size of 2.83 nm. The optimal excitation and emission wavelengths were 320 nm and 430 nm, respectively. There was overlapping overlap between the excitation or emission spectrum of N-CDs and the UV absorption band of MnO_4^-. The inner filter effect (IFE) was formed between N-CDs and MnO_4^-, which led to the fluorescence quenching of N-CDs. The fluorescence quenching intensity of the system showed a good linear relationship with the concentration of MnO_4^- from 0.13 to 9.00 μM, and the limit of detection (3.00σ/k) of MnO_4^- was 0.12 μM. The proposed method was then used to measure MnO_4^- in polluted water with recoveries of 99.02 to 101.04%. The synthesized N-CDs offering were MnO_4^- detection in wastewater samples are extremely profound for environmental evaluation.

Keywords Nitrogen-doped carbon dots · *Acer saccharum* marsh (L.ex Blonk.) Ostenf · MnO_4^- · Fluorescence quenching · Inner filter effect

1 Introduction

Potassium permanganate ($KMnO_4$) is a strong oxidant and is usually used as a disinfectant and antiseptic, it is widely applied in daily life and industry, e.g., treating polluted water and diseases in fish [1, 2]. MnO_4^- also is toxic, corrosive, and carcinogenic [3], and excess MnO_4^- can lead to skin irritations, neurological disorder, respiratory damage, gastrointestinal distress, and even genetic mutation [3, 4], and thus excess MnO_4^- can be seriously hazardous to human health [5]. Accordingly, selective and sensitive determination of MnO_4^- in polluted water is critical for environmental evaluation [6]. A variety of detection methods have been developed such as flame atomic absorption spectrophotometry [7, 8], inductively coupled plasma mass spectrometry [9, 10], and electrochemistry [11]. However, most of these techniques require sophisticated equipment and a skilled operator and are time-consuming. By contrast, fluorescent methods involved with simple operations and a fast response. Hence, novel fluorescent sensors to detect trace MnO_4^- in simulation samples are urgently needed. Currently, the MnO_4^- determination can be done by porous metal nanosheets [12], organic layer [13], metal organic framework [14, 15], coordination polymer [16, 17], etc. However, the above fluorescent probes are usually toxic and harmful, complicated in synthesis process or expensive. To overcome the above limitations, it is necessary to seek a convenient, low toxicity, economic fluorescent material with high fluorescence quantum yield.

Carbon dots (CDs) have attracted widespread attention due to their low cytotoxicity, high biocompatibility, good chemical and photo stability, easy preparation methods, and tunable emission [18–20]. They have been widely used in drug delivery [21], sensing [22–24], bioimaging [25], photocatalysis [26], electromagnetic composites [27–32],

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Analytical Methods

ROYAL SOCIETY OF CHEMISTRY

PAPER

A novel fluorescent nanoprobe for sensitive detection of 6-thioguanine in human serum based on Cu/Ag nanoclusters†

Wanping Chen,[a] Dongkao Ma,[a] Meng Yang,[a] Yi Zhu,[a] Yunping Wu,[a] Bi Li,[a] Junlong Zhang,[a] Jinju Yang,[a] Yan Huang[a] and Jianxin Ke[*ab]

6-Thioguanine (6-TG) is a purine analog antitumor drug used to treat childhood acute leukemia and inflammatory bowel disease. However, overdosage use of 6-TG can cause serious adverse effects. Therefore, monitoring the real 6-TG concentration in the human body is critical during drug therapy. In this work, a Cu/Ag nanocluster (NC)-based fluorescent nanoprobe for the detection of 6-TG was developed. The maximum emission wavelength of Cu/Ag NCs was observed at 562 nm with an excitation wavelength of 350 nm. A selective fluorescence quenching effect of 6-TG on the Cu/Ag NCs was found. Under optimum conditions for the determination of 6-TG, a wide linear concentration range from 2.5 to 125 μmol L^{-1} was observed with a limit of detection (LOD) of 1.97 μmol L^{-1}. The characteristics of simple operation, high sensitivity and selectivity make this fluorescent nanoprobe a promising candidate for the detection of 6-TG in biological samples, as demonstrated by the application in spiked human serum with recoveries of 97.6 to 104.8%. In general, the proposed method has great potential for the detection of 6-TG in biological samples.

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Introduction

6-Thioguanine (6-TG) is a purine analog antitumor drug with immunosuppressant capability, and is utilized to treat child-hood acute leukemia and inflammatory bowel disease.[1,2] However, overdosage use of 6-TG can result in serious adverse side effects such as bone marrow hypoplasia, liver damage and gastrointestinal complications.[3] Hence, considering the fact 6-TG concentration in the human body is of utmost importance. To date, several methods have been developed for the detection of 6-TG, including high performance liquid chromatography (HPLC),[4] liquid chromatography-mass spectrometry (LC-MS),[5] surface enhanced Raman scattering (SERS),[6,7] electrochemical[8,9] and colorimetric analysis,[10] etc. Despite these advancements, these methods are rather expensive and rely on expensive instruments, time-consuming and require intricate operations, or have low sensitivity. Fluorescence methods have been employed for the detection of 6-TG using fluorescent nanoprobes such as g-C_3N_4 nanosheets[11] and carbon dots.[12,13] However, the synthesis of these nanoprobes requires high temperature hydrothermal or pyrolysis processes, which in many cases limits their practical applications.

Metal nanoclusters, as an emerging class of fluorescent nanomaterials, are generally composed of a few to dozens of metal atoms.[14] Copper, being an earth-abundant and low-cost metal, can be easily synthesized into copper nanoclusters (CuNCs) using various protective agents, such as proteins,[15,16] DNA,[17,18] thiols,[19,20] dendrimers[21,22] and organic small molecules.[23,24] Compared with other noble metals, CuNCs exhibit excellent properties, including large Stokes shifts, good water solubility, excellent catalytic activity, high biocompatibility and strong fluorescence, as a result, they have been widely used in sensing,[25,26] bioimaging[27] and chemical catalysis.[28] Thiols are widely used as a reducing agent and stabilizing agent for the preparation of CuNCs. However, thiolate-protected CuNCs are quickly oxidized in air, which limits their applications.[29] Recently, metal doping is an effective strategy for improving the properties of CuNCs.[30,31] Alloy nanoclusters have many advantages such as a higher quantum yield (QY), good photostability and a larger Stokes shift.[32] And it was reported that the properties of alloy nanoparticles surpass those of either constituent element. Recently, Chai and co-workers reported a dual-mode colorimetric and fluorometric probe for Hg^{2+} based on silver-copper bimetallic nanoparticles.[33]

In this study, a novel fluorescent probe based on Cu/Ag NCs was proposed for the rapid and selective determination of 6-TG. The Cu/Ag NCs were prepared using cysteamine (Cys) as the reducing agent and stabilizing agent in a one-pot method at

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†Electronic supplementary information (ESI) available. See DOI: https://doi.org/10.1039/d3ay00318a

NJC

ROYAL SOCIETY OF CHEMISTRY

PAPER

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Facile synthesis of nitrogen-doped carbon dots from pork liver and its sensing of 6-thioguanine based on the inner filter effect†

Wenying Chen,[a] Jun Tan,[b] Nanxue Wu,[a] Donglao Hu,[a] Yunying Wu,[a] Zhongmin Feng,[a] Meiyun Yan,[a] Xizhu Gao[a] and Jianxin Xie[a]

In this work, a facile one-step hydrothermal method was developed to synthesize nitrogen-doped carbon dots (N-CDs) using pork liver. The quantum yield of the prepared N-CDs was as high as 31.79%. The excitation and emission wavelengths of the N-CDs were 329 and 418 nm, respectively. The excitation spectrum of the N-CDs has a big overlap with the absorption band of 6-thioguanine (6-TG), which formed an inner filter effect (IFE) between them. 6-TG acted as an effective absorber in IFE to quench the fluorescence of the N-CDs. The concentration of 6-TG was well linear with the fluorescence quenching intensity of the system from 1 μM to 200 μM. The limit of detection was as low as 0.75 μM. This proposed method was successfully applied in selective and sensitive determination of 6-TG in human serum with recoveries of 96.0–103.6%.

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1. Introduction

6-Thioguanine (6-TG), which is one of the mercaptan purine-antidotes, has been widely used in the treatment of acute leukemia, autoimmune disease and inflammatory bowel disease.[1,2] However, overdosage of 6-TG would lead to serious side effects, such as bone marrow depression, gastrointestinal complications and liver problems.[3,4] Therefore, selective and sensitive analysis of 6-TG is of great necessity. Various instruments have been used for 6-TG analysis, including high performance liquid chromatography,[5] electrochemical methods,[6,7] localized surface plasmon resonance[8] and surface enhanced Raman scattering.[9] However, most of these methods depend on expensive equipments, which is not easy to operate and time-consuming. In contrast, the fluorescence method has advantages of high sensitivity, easy operation and rapid response; therefore, it is crucial to develop a novel fluorescence nanoprobe for trace 6-TG detection.

Carbon dots (CDs), which have advantages of excellent optical properties and photostability, good aqueous solubility, high biocompatibility, low cytotoxicity, and being environmentally friendly, have been widely applied in bioimaging,[10–12] sensing,[13–15] photocatalysis,[16,17] optoelectronic devices[18,19] and so on. Recently, heteroatom-doped CDs have attracted increasing interest due to their superior tunable optical and electron transfer properties.[20–22] Nitrogen-doping is the most widely adopted strategy to improve the properties of CDs. Synthesized chemical and natural biomass are two main types of precursor materials for the synthesis of nitrogen-doped CDs (N-CDs) in the published reports.[23,24] Compared to the synthesized chemical, natural biomass has the advantages of high abundance, sustainability, easy modifications, low cytotoxicity, and good biocompatibility.[25–27] Carbohydrates, proteins and other molecules in the literature are sources of carbon and nitrogen for CD synthesis. Many types of N-CDs have been synthesized from abundant biomass resources, such as grass, milk, vegetables, and plant leaves.[28–30] More importantly, biomass can be well-preserved during the carbonization without the extra addition of a precursor. The inner filter effect (IFE) occurs when the absorption spectra of the absorbers have a large overlap with the excitation or emission spectra of the fluorophores. The IFE does not need complex operation processes or CD functionalization and has shown higher selectivity and enhanced sensitivity compared to other fluorescence quenching mechanisms.[31] Fluorescent probes that are based on IFE have been synthesized for the determination of ketoprofen,[32] gefitinib,[33] and Cu^{2+} and I^- ions.[34]

In this work, pork liver was used as the sole carbon source to prepare N-CDs by a facile one-step hydrothermal method, as shown in Scheme 1, and the prepared N-CDs were successfully applied in selective and sensitive detection of 6-TG in human serum samples based on the IFE.

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生物质衍生荧光碳点高灵敏检测环境水样中四环素

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何晓婷[1]，刘　昕[1]，谢建超[1,2]*

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摘　要：以生物质柠檬酸为碳源，通过水热法一步合成了氮掺杂的碳点(N-CDs)。该荧光碳点具有良好的水分散性，平均粒径约为 3.1 nm。最佳激发波长为 352 nm，最佳发射波长为 450 nm。N-CDs 的激发波长依赖性和浓度猝灭效应使其能够用于检测四环素(TC)。N-CDs 与 TC 间的静电相互作用导致荧光猝灭，形成 N-CDs-TC 的荧光探针。考察了缓冲液 pH 和反应时间对荧光探针荧光强度的影响，在最佳条件下，检测系统的荧光猝灭强度与四环素的浓度在 1.25～15.0 μmol/L 和 15.0～25.0 μmol/L 范围内呈现良好的线性关系，线性方程为 $F_0/F=0.0229c+1$，$R^2=0.9959$；1 μmol/L～15.0 μmol/L 和 15.0～25.0 μmol/L 两段线性关系的 R^2 分别为 0.9920，检出限为 0.28 μmol/L。该方法成功用于水样中四环素含量的测定，加标回收率为 96.1%～103.4%，相对标准偏差为 1.6%～3.4%。

关键词：碳点；绿茶；水热法；四环素；荧光猝灭

中图分类号：O657.39　　**文献标识码**：A　　**文章编号**：1004-4957(2023)03-0454-06

四环素(TC)是一种高效广谱抗菌药物饲料添加剂，能有效预防水产动物细菌性疾病，促进动物生长，提高饲料转化率[1]。TC 在水环境中的残留会对环境生态和人体产生副作用，过量摄入 TC 会影响骨骼发育[2]，损害肝肾功能[3]，因此开发出灵敏、快速、简便的检测 TC 的方法至关重要。目前检测 TC 的方法有高效液相色谱法[4]、荧光分析法[5]、电化学法[6]等。这些检测方法虽具有灵敏度高、选择性好等优点，但也存在仪器昂贵、操作复杂、耗时长、样品预处理繁琐等缺点。因此，建立简便、快速、灵敏的检测 TC 的方法具有重要的现实意义。

碳点(Carbon dots，CDs)作为新型纳米材料，因其优异的荧光性质、生物相容性、低毒等特点，在荧光检测、生物成像[7]、药物递送[8]、生物传感[9]、光催化[10]、光电转换[11]等领域得到广泛关注[12,13]。为了提高碳点的荧光量子产率，通常采用掺杂杂原子或两种及以上的前驱体进行反应[14]。其中掺杂杂原子的方法，只需选择合适的杂原子前驱体反应即可，操作简单[15]。一般可以选择含有氮元素的生物质材料，一步简便合成氮掺杂碳点[16]。化学修饰是指对碳点的边缘或表面的官能团进行修饰，如用聚乙二醇[17]、尿素[18]、甘氨酸[19]等。

本文以柠檬酸为碳源，采用水热法一步合成了 N-CDs，同时考察了四环素对 N-CDs 荧光强度的影响，建立了检测四环素的荧光探针，并应用于实际水样中四环素含量的测定。

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摘 要：目的 [illegible] **方法** [illegible] **结果** [illegible] **结论** [illegible]

关键词： [illegible]
[illegible]

Discrimination study of Pu-erh tea made from ancient trees from different tea mountains based on Fourier transform infrared spectroscopy

CHEN Wen-Jing[1], LI Liang-Xing[1], LI Ming[1], MA Cai-Feng[1], DUAN Chao-Feng[2], ZHOU Hong-Jie[2], WU Xian-Xue[1,2*]

[illegible]

ABSTRACT: Objective [illegible] **Methods** [illegible]

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***通讯作者：** [illegible]
***Corresponding author:** [illegible]

[illegible]

黑磷量子点催化增强 luminol-H_2O_2 发光体系测定对苯二酚

[illegible]

[illegible]

[illegible]

[illegible]

Black phosphorus quantum dots catalytic enhanced luminol-H_2O_2 chemiluminescence and the determination of hydroquinone

CHEN Wenjing, WU Yunying, LIN Hong, ZHU Xiaohong, LI Xi, HE Maoting, XIE Jianxin*

[illegible]

Abstract: [illegible]

Key words: [illegible]

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课程名称	课程类别	上课学期	学分	成绩
外国语	公共课	第一学期	4	79
[illegible]	公共课	第一学期	1	87
科学社会主义理论与实践	公共课	第一学期	1	合格
材料化学	学位课	第一学期	3	80
[illegible]化学	学位课	第一学期	3	[illegible]
现代[illegible]	学位课	第一学期	2	[illegible]
[illegible]化学	学位课	第一学期	2	[illegible]
[illegible]化学	学位课	第二学期	2	[illegible]
化学研究方法	学位课	第二学期	3	[illegible]
稀土化学	专业课	第二学期	2	[illegible]
[illegible]	专业课	第二学期	2	[illegible]

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（公章）

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考试时间：2014 年 6 月

总分： 458

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Journal of Photochemistry & Photobiology A: Chemistry

Self-assembly of efficient flower-like Bi_2SiO_5 photocatalyst through Pt modification

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ARTICLE DATA

Keywords:
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Pt
Flower-like
Photocatalysis

ABSTRACT

The flower-like Pt/Bi_2SiO_5 photocatalyst was successfully synthesized via a light-induced photoreduction method and applied for removing Rhodamine B (RhB). Firstly, the Bi_2SiO_5 microflower was prepared by hydrothermal method, and then the flower-like Bi_2SiO_5 was synthesized with H_2PtCl_6 as the platinum source, methanol as electron donor and the 300 W tungsten lamp as light source to reduce Pt to the metal of photocatalyst. H_2PtCl_6 was not only used as Pt precursor, but also could form the SPR recombination assembled unit. Flower-like structure can be stabilized with the existence of Pt. The novel p-n heterojunction improved photocatalytic performance. The material's photocatalytic activity was tested by RhB degradation under visible light irradiation. When the dosage of Pt/Bi_2SiO_5 solution is 1.2 mL, the prepared optimized material was tested to 0.23%-Pt/Bi_2SiO_5. The total degradation efficiency of RhB reached 96.6% after only 1 min of light irradiation and 0.23%-Pt/Bi_2SiO_5 and the reaction rate constant were 46.5 h^{-1} and 7.402 $(min \cdot g)^{-1}$ higher than Bi_2SiO_5 (0.27 and 0.04 h^{-1}, respectively). The physical and chemical properties of 0.23%-Pt/Bi_2SiO_5 photocatalyst were characterized by XRD, XPS, SEM, TEM, UV-vis DRS and PL techniques. The effects of pH value for removing RhB in water was investigated. The possible photocatalytic mechanism was proposed on the basis of trapping experiments. 0.23%-Pt/Bi_2SiO_5 photocatalyst also displayed high stability and durability during three successive cycles. Thanks to the small particle size, tougher flower structure, the photocatalytic performance was considerably improved. A flower-like morphology composed of an assembly.

1. Introduction

Rhodamine B (RhB) [1] is a kind of fluorescent dye. Synthetic wastewater is produced in the dyeing and printing industry [2,3]. RhB is difficult to be removed from the environment because of its stable chemical structure and its toxicity to the living organisms [4,5]. RhB can affect the central nervous system through (1) destroying endogenous hormones to antagonizing the effects of endogenous hormones; (2) disrupting the synthesis and metabolism of endogenous hormones, leading the endocrine system disturbance from multiple levels. Catalysis is a crucial science in enzyme activity, among RhB's, TiO$_2$ photocatalysis [6,7] has the strongest oxidizing effect and the application in water remediation [8]. It is not only an active component of coal mining machine in China but also used in many personal care products, such as shampoo, lotion, and moisturizer. [9]. was applied into the environment through wastewater effluent from hospital effluent, municipal treatment plants and livestock activities. There are many methods to remove RhB, including biological method [4], chemical oxidation method [5], adsorption method [6,7] and photocatalysis methods [8,9]. Among them, photocatalysis method is the most classic for wastewater remediation technology owning to its economic, safe, facile, low energy consumption and manifold use [10–12].

Among Bismuth-based photocatalysts, Bi_2SiO_5 has been widely used in its good photocatalytic and optical, semiconductor structure. As a typical Sillenite-like oxide, Bi_2SiO_5 was built up with $[BiO_4]^{5-}$ layers sandwiched between SiO_4^{4-} groups in the order Bi_2SiO_5 as a photocatalyst can absorb ultraviolet light. Some studies have confirmed the photocatalytic activity of Bi_2SiO_5 nanorods. For example, Di et al. [13] have reported that by constructing narrow quantum dots Bi_2SiO_5 nanorods, 72.5% of RhB was photodegradated after 4 h of irradiation under UV-light. Chen et al. [14] have synthesized Bi_2SiO_5 nanosheets (10 nanometer scale). After 30 min light irradiation of 500 W, the UV removal efficiencies were up to 90%. Liu et al. [15] have fabricated RhB/Bi_2SiO_5 heterostructure by in-situ photoreduction method, and the degradation of 10% after 30 min light irradiation of 150 L. In this, when using pure Bi_2SiO_5 as the comparable materials to degrade the pollutants, the degradation effect was not very good since high recombination rate of charge carriers would limit the photocatalytic activity. Moreover, various

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Solid State Sciences

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Controllable synthesis of $Bi_2SiO_5/Bi_4Si_3O_{12}$ heterostructure and it's specific adsorption and photocatalytic performance

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Keywords:
Bi_2SiO_5
$Bi_4Si_3O_{12}$
Adsorption
Photocatalysis

A series of $Bi_2SiO_5/Bi_4Si_3O_{12}$ composite materials was prepared by a one-step hydrothermal method with citric acid as the additive. In the same hydrothermal condition, the precursors of Bi_2SiO_5 and bulk spherical of $Bi_4Si_3O_{12}$ were prepared by adjusting $Bi(NO_3)_3$ solution with ethylene glycol and benzyl alcohol as solvents, respectively. The obtained materials were characterized by the XRD, XPS, SEM, TEM, BET, UV-vis spectroscopy and PL. The Y_1-Bi_2SiO_5, Bi_2SiO_5/$Bi_4Si_3O_{12}$ and $Bi_4Si_3O_{12}$ photocatalysts were applied to remove 4-Chlorophenol (4-CP) and the 4-CP removal rates were 47.4%, 89.8% and 20.4% after 2.5 hrs of UV light irradiation, respectively. Photocatalytic activity of $Bi_2SiO_5/Bi_4Si_3O_{12}$ was better than that of Bi_2SiO_5 and $Bi_4Si_3O_{12}$ because the heterojunction of $Bi_2SiO_5/Bi_4Si_3O_{12}$ had the matching band structure between Bi_2SiO_5 and $Bi_4Si_3O_{12}$, the recent separation efficiency and transport efficiency were improved. The Bi_2SiO_5-$Bi_4Si_3O_{12}$ shows the highest reaction rate, which is 2.1, 27.37 and 137.76 times higher than that of Bi_2SiO_5, $Bi_4Si_3O_{12}$, TiO2 and P25 photocatalysts, respectively. The effects of pH value and photocatalyst dosage were optimized for removing 4-CP in water. The possible photocatalytic mechanism was proposed based on the trapping fluorescent experiment and the energy band position. Surprisingly, the $Bi_2SiO_5/Bi_4Si_3O_{12}$ photocatalyst had specific adsorption performance on 4-CP corresponding to 89% due to the 4-CP hydrogen bonding. Over 90% 4-CP was photodegraded from citric acid treated Bi_2SiO_5. Thanks to the weak positive zeta potential for controlled as-obtained Bi_2SiO_5, $Bi_2SiO_5/Bi_4Si_3O_{12}$ and $Bi_4Si_3O_{12}$ with 1g changing the solvent in hydrothermal process. The $Bi_2SiO_5/Bi_4Si_3O_{12}$ possesses synergistic effect of adsorption and photocatalysis for hydrophobic organic pollutant in water. It is hoped that this work can be an effective material for removing hydrophobic organic pollutants in water and the $Bi_2SiO_5/Bi_4Si_3O_{12}$ composites can contribute a promising photocatalyst for removing all kinds of wastewater containing chlorinated organic pollutants.

1. Introduction

Persistent organic pollutants (POPs) are dangerous organic substances that can transform in the environment through chemical, photochemical, biochemical, or microbial reactions. Because of their toxicity, persistence, and bioaccumulation, POPs have become the most concerned problems after ozone depletion and climate warming. The environmental estrogens including nonylphenol, octylphenol, 17α-ethynylestradiol (EE2), 17β-estradiol (E2), estriol (E3) and estrone, 17α-ethynylestradiol (EE2) may be discharged into the environment mainly through sewage and sludge and cause feminization of several biological species in the water. Among the estrogens under research, E2 and EE2 are two of the most active estrogens, exhibits high estrogenic potency and widely used in [illegible] in the water, regardless of treatment processes, concentrations in many generated wastewaters are, on average, below environmental. EE2 have a half-life of about 1.5 days in the aquatic environment and is therefore inherently persistent in comparison to natural estrogens. Long-term exposure to EE2 may lead to chronic [illegible] even cause the extinction of organisms [1,2]. Bisphenol A (BPA) have many orders of magnitude lower estrogenic activity comparing EE2, but its chronic concentrations in wastewaters also have attracted [3,4]. BPA is widely used as epoxy plastic, polycarbonate plastic bottles, baby products and resins. It is only a concern in the water environment and its concentration varied greatly in different water resources (ng/L-μg/L). In the, over 90

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云南大学研究生成绩通知单

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姓名：陈宇　　学号：[redacted]　　年级：2015级

2015年秋季学期

序号	课程名称	课程性质	学分	成绩	考核结果
1	英语综合(上)	学位公共	1	73.00	
2	英语听说(上)	学位公共	1	80.00	
3	文献检索(理科)	公共选修	1	86.00	
4	中国特色社会主义理论与实践研究	学位公共	2	85.00	
5	物质结构基础与表征	学位基础	4	82.00	
6	定量与化学化工初步	学位基础	3	90.00	
7	现代合成原理	学位基础	4	76.00	
8	实践	教学实践	1	0.00	合格
9	学术活动	学术活动	1	0.00	合格

学分小计：19　　总学分：18.00

2016年春季学期

序号	课程名称	课程性质	学分	成绩	考核结果
1	学位外语	免修	0		合格
2	自然辩证法	学位公共	1	81.00	
3	英语听说(下)	学位公共	1	77.00	合格
4	英语综合(下)	学位公共	1	83.00	
5	分离分析化学	学位专业	3	80.00	
6	分子催化	学位专业	3	79.00	
7	现代化学实验技术(一)	学位基础	2	89.00	
8	现代化学实验技术(二)	学位基础	2	93.00	

学分小计：15　　总学分：13.00

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2017年11月23日

全国大学英语四级考试(CET4)成绩报告单

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准考证号：530060062104818

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听　　力：141

阅　　读：188

综　　合：39

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第1页（共1页）

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项目编号：

云南省科技厅科技计划项目合同书

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承担管理单位（甲方）：

项目承担单位（乙方）：

项目推荐部门（高校）：

项目负责人：　　电话：

项目起止年限：

云南省科学技术厅制

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[illegible]
[illegible]

木质素改性沥青高温性能试验

程涨[1,2]，陶宜良[1]，王鸿[1]，韩振球[2]

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摘　要：为研究木质素对沥青抗老化性能的改善效果，分别制备了掺入不同木质素（碱木质素（AL）、磺化碱木质素（SAL）、硫酸盐木质素（KL）、磺化硫酸盐木质素（SKL）、木质素磺酸钙（CLS））的改性沥青，并对其进行了旋转薄膜烘箱（RTFO）短期老化和压力老化容器（PAV）长期老化处理。采用动态剪切流变仪（DSR）测试了老化前后沥青的车辙因子（$G^*/\sin\delta$）和相位角（δ），并采用多应力蠕变恢复（MSCR）试验评价了沥青的高温抗车辙性能。结果表明：与基质沥青相比，木质素的掺入提高了沥青的高温抗车辙性能，且磺化木质素改性沥青的高温性能最优。短期老化后，木质素的掺入降低了沥青的抗老化性能，且磺化木质素改性沥青的抗老化性能最优。长期老化后，木质素的掺入降低了沥青的车辙因子，且磺化木质素改性沥青的车辙因子最大。木质素的掺入降低了沥青的相位角，且磺化木质素改性沥青的相位角最小。木质素改性沥青的车辙因子和相位角的变化规律表明，木质素的掺入改善了沥青的抗老化性能，且磺化木质素改善效果最优。

关键词：木质素；沥青改性；动态剪切流变；动态车辙

中图分类号：TU411　　**文献标志码**：A　　**文章编号**：2095-1914(2019)03-0141-07

Experimental study on performance of lignin-modified asphalt at high temperatures

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Abstract: In order to study the effect of lignin content on the properties and aging resistance of asphalt binder at high temperatures, asphalt samples were prepared with different lignin contents (AL, SAL, KL, SKL, CLS and LSA). The viscoelastic behavior and dynamic shear rheological tests of the asphalt at high temperatures were carried out to evaluate the properties of asphalt samples before and after short-term aging. The rutting parameters ($G^*/\sin\delta$) and softening point increment (SPI) were used. The flexibility parameter (FRR) of complete shear modulus aging index (MG^*_{ir}) and phase angle aging index (δ_{ir}) were utilized to evaluate the aging resistance of the lignin-modified asphalt. The results show that: the addition of lignin in asphalt before aging increased the penetration and phase angle, and increased the softening point and complex shear modulus (G^*), indicating that the lignin admixture could significantly improve the stability of asphalt at high temperatures. The change of rutting factor ($G^*/\sin\delta$) was different from that, when the lignin content exceeded 4%. For example, the high temperature performance grade of asphalt could be improved by one level. The dosage had a negative effect on the low temperature performance of the asphalt at the maximum of the content, but it still met the requirements of the current specifications of lowest content when the content was not more than 12% (by weight). The phase angle of the lignin-modified asphalt was lower than that of the base asphalt before aging, and the phenomenon was opposite after the short-term aging. It was believed that the effects of short-term aging on the lignin-modified asphalt. It was just the reverse of the changes of complex shear modulus (G^*) of binder asphalt due to the first aging, but the phenomenon of lignin that hydrogenation and further crosslinking of asphalt during the short aging. It was obvious that lignin could delay the thermal aging of asphalt. Comparing with different evaluation indexes of anti-aging performance, it was found that the phase angle (δ) could well characterize the variation law of viscoelastic index of asphalt materials, so the phase angle aging index (δ_{ir}) was recommended to be the evaluation index of the lignin-modified asphalt aging performance.

Keywords: lignin; modified asphalt; high temperature rheology; short-term aging

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短期老化对木质素改性沥青高温流变性能的影响

Influence of short-term aging on rheology of lignin modified asphalt

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Abstract

Key words

木质素改性沥青的短期老化性能研究

Short-term Aging Properties of Lignin Modified Asphalt

Abstract: In order to explore the effect of short-term aging on lignin modified asphalt, the examinations of properties and dynamic shear rheological tests were carried out to analyze the properties of asphalt before and after short-term aging, and the anti-aging mechanism of lignin modified asphalt was analyzed by thermogravimetric curve (TG/DTG). The results showed that the addition of lignin improves the high temperature performance of asphalt, but has a negative effect on the low temperature performance, so it needs to be improved. The change of performance index of lignin modified asphalt after aging is smaller than that of base asphalt. Lignin improves the anti-aging property of asphalt. Twelve percent is considered as the best content. Lignin itself has good thermal stability, which not only improves the thermal stability of asphalt, but also delays the aging process of asphalt.

Key words: lignin; modified asphalt; short-term aging; high temperature properties

[illegible]

木质素改性沥青的温度敏感性分析

[illegible]

[illegible]

[illegible]

温度敏感性是沥青在服役过程中最为关键的性能之一，温度变化引发沥青性能的变化，进而影响沥青路面的使用性能。因此，研究沥青的温度敏感性对于沥青路面的设计、施工和养护具有重要的意义。目前，国内外学者对沥青的温度敏感性进行了大量的研究，并提出了多种评价指标，如针入度指数（PI）、针入度黏度指数（PVN）、黏温曲线斜率（VTS）等。这些指标大多是基于沥青的针入度、软化点和黏度等基本性能参数计算得到的，能够在一定程度上反映沥青的温度敏感性。

随着科技的不断进步，新型改性剂不断涌现，为沥青的改性提供了更多的选择。木质素是一种来源广泛、可再生的天然高分子聚合物，具有独特的三维网状结构和丰富的官能团，如羟基、甲氧基、苯环等。这些官能团赋予了木质素良好的抗氧化性、紫外线吸收性和与沥青良好的相容性。将木质素作为改性剂加入沥青中，可以改善沥青的高温稳定性、抗老化性能和抗紫外线性能，从而延长沥青路面的使用寿命。

目前，国内外学者对木质素改性沥青的研究主要集中在木质素的来源、掺量、改性工艺以及改性机理等方面。例如，有研究表明，适量的木质素可以显著提高沥青的软化点和黏度，降低针入度，从而改善沥青的高温性能。同时，木质素中的酚羟基等官能团能够与沥青中的沥青质发生物理化学作用，形成稳定的网状结构，从而提高沥青的抗老化性能。此外，木质素还具有一定的紫外线吸收能力，能够减缓沥青在紫外线照射下的老化速率。

然而，现有研究大多集中在木质素改性沥青的宏观性能上，对其微观结构和改性机理的研究相对较少。沥青的温度敏感性不仅与宏观性能有关，还与其微观结构密切相关。因此，从微观角度深入研究木质素改性沥青的温度敏感性，对于揭示其改性机理、优化改性工艺具有重要的理论意义。

本研究拟采用动态剪切流变仪（DSR）对木质素改性沥青的流变性能进行测试，分析其在不同温度下的流变特性。通过计算针入度指数（PI）、针入度黏度指数（PVN）等温度敏感性指标，评价木质素掺量对沥青温度敏感性的影响。同时，结合傅里叶变换红外光谱（FTIR）分析，探讨木质素与沥青之间的相互作用机理。本研究旨在为木质素改性沥青的工程应用提供理论依据和技术支持。

1 试验材料与方法

1.1 试验材料

试验所用沥青为壳牌70#基质沥青，其技术指标如表1所示。

表1 壳牌70#基质沥青技术指标

Table 1 Technical indexes of Shell 70# matrix asphalt

试验项目	试验结果	技术要求
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Journal of Renewable Materials
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Article

Tech Science Press

Analysis of the Mechanism and Effectiveness of Lignin in Improving the High-Temperature Thermal Stability of Asphalt

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Abstract: The use of lignin, which is a by-product of the pulp and paper industry, in the development of asphalt binders would contribute to waste reduction, providing environmental, economic, and social benefits. In this study, samples of lignin-modified asphalt binder samples with different content of lignin (3%, 6%, 9%, 12%, and 15%) and unmodified asphalt (control) were tested using Fourier transform infrared spectroscopy (FTIR), dynamic shear rheometer (DSR), and thermogravimetry. The mechanism and effectiveness of lignin in improving the thermal stability of asphalt at high temperatures were analyzed. The FTIR analysis shows that no new characteristic absorption peak is seen in the infrared spectra of the lignin-modified asphalt binder samples, and some bands characteristic of lignin-related peaks gradually increased with the increase of lignin content. This suggests that the modification of lignin-modified asphalt binder samples was due to physical blending rather than chemical modification. The increase of lignin content in the lignin-modified asphalt samples increases the complex shear modulus (G^*) of the samples and decreases the phase angles of the samples. Similarly, the anti-rutting performance ($G^*/\sin\delta$) of the samples improves with the increase in lignin content, but this is not significant after any addition of lignin that exceeds 12% of asphalt mass. Thermal characterizations show that the thermal decomposition rate of lignin is lower, and its residual amount is higher compared to that of asphalt, which is a major reason for the improved stability of lignin-modified asphalt binders at high temperatures. The effect of lignin on the thermal stability of asphalt is dependent on both lignin content and temperature. It has a positive effect on the thermal stability of asphalt at high temperatures within the range of asphalt service temperatures (25°C–200°C). Additionally, from the pyrolysis viewpoint, it was explained that excessive lignin addition is not beneficial to the thermal stability of asphalt at high temperatures, which is consistent with the DSR test result conducted high temperatures.

Keywords: Lignin modified asphalt; high temperature stability; FTIR; TG

DOI: [illegible]

反射隔热型涂料在高原山区混凝土桥梁上的应用

[illegible]

[illegible]

摘要：[illegible]

关键词：[illegible]

中图分类号：[illegible] 文献标志码：[illegible] 文章编号：[illegible]

Application of heat reflective and insulation paint on concrete bridges in plateau mountain area

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Abstract: A [illegible] heat reflective and insulation paint was prepared with [illegible], glass microspheres, black hollow ceramic micro-bead, epoxy resin, and composite curing agent, and then applied on the [illegible] concrete bridge in the [illegible] section of Yuanjiang-to-Mohei Expressway in Yunnan Province, a low-latitude and high-altitude area, to verify its action in actual engineering. The construction process flow was summarized and its cooling effect was examined. The paint could effectively eliminate the cracking and durability reduction caused by daily temperature difference for concrete bridge.

Keywords: concrete bridge; heat reflective and insulation paint; construction; cooling effect

[illegible]

[illegible]

建筑用双组分环氧隔热腻子的制备

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摘要：为了减小建筑上的温差应力对产生裂纹，本文通过在环氧树脂中加入空心玻璃微珠，以聚酰胺为固化剂制备了环氧隔热腻子，并研究了不同填料体积比对腻子的隔热性能、力学性能、耐水性能、耐候性能的影响。结果表明：当空心玻璃微珠与环氧树脂体积比为1:1时，腻子的导热系数为0.117 W/(m·K)，隔热性能较好；当空心玻璃微珠与环氧树脂体积比为1:2时，腻子的抗压强度为11.7 MPa，抗折强度为3.9 MPa，力学性能较好；腻子的吸水率为0.4%，耐水性较好；腻子经过紫外老化1000 h后，质量损失率为0.3%，耐候性较好。

关键词：环氧树脂；空心玻璃微珠；腻子

中图分类号：TU57+1.2　　**文献标识码：**A　　**文章编号：**1001-702X(2021)02-0128-04

Preparation of two-component thermal insulation epoxy putty for building

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Abstract: In order to reduce the durability of the produced due to organic and construction caused by temperature stress, the laboratory prepared a two-component epoxy thermal insulation putty mixed with A and B components. Using batch scraping performance as an index, determine the ratio of epoxy putty and study the influence of material composition and thickness on the anti-pressure and heat insulation effect of the hot glass and its durability. The results show that the heat insulation effect decreases with the increase of hollow glass beads and putty powder. When the reaction ratio is 1:1 hollow glass beads and putty powder, the water ratio is 1:0.7:1.5, which can effectively reduce the temperature of 0.117 using titanium dioxide can effectively reduce the temperature by 12.1 %. The putty layer has good heat resistance and weatherproof resistance to corrosion.

Key words: epoxy thermal insulation putty batch scraping performance durability

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出生日期	[illegible]	学　号	[illegible]	入学年月	[illegible]
学科专业		材料学			

序号	课程名称	学时数	各学期成绩			总评成绩	[illegible]	学分
			1	2	3			
1	自然辩证法	54	77			77	[illegible]	2
2	[illegible]	36		[illegible]		[illegible]	[illegible]	1
3	英语	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
4	英语	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]
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13	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]
学分总计								[illegible]
[illegible]	[illegible]							

注：[illegible]

全国大学英语六级考试
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总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
427	99	187	141

口　试

准考证号：--

考试时间：--

成绩	--

成绩报告单编号：232253006000027

教育部教育考试院
证书专用章

校验码：IZAZ TOTX ZOXU 6HR3

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中国腐蚀与防护学报
Journal of Chinese Society for Corrosion and Protection
Vol.43 No.2 Apr. 2023

椰油酸二乙醇酰胺对钢在三氯乙酸溶液中的缓蚀性能

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Inhibition Performance of Coconut Diethanolamide on Cold

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化学研究与应用
Chemical Research and Application
Vol.35,No.9 Sep.,2023

文章编号:1007-1656(2023)09-2028-10

基于响应面法优化油菜籽饼粕缓蚀剂的提取制备工艺

仇 莉,李向红,雷 然,邓书端*
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Optimization of extraction and preparation process of rapeseed meal inhibitor based on response surface methodology

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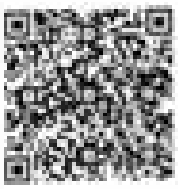
类别	课程名称	学时数	学分	考核方式	成绩	重考成绩	补考成绩	选修课类别
学位课	木制品材料与结构与性	32	2.0	1	85.00			
	热质工程基础	32	2.0	1	85.00			
	试验设计与数据处理	32	2.0	1	85.00			
	计算机基	32	2.0	1	85.00			
	高分子材料结构及力学性能（专题）	16	1.0	1	85.00			
	英语	48	3.0	1	72.00			
	仪器分析试验技术（专题）	16	1.0	1	85.00			
	木制品加工技术与装饰	32	2.0	1	85.00			
	应用数理学	32	2.0	1	72.00			
	学位课小计		16.0					
非学位课	现代木材加工技术	32	2.0	1	85.00			
	实践环节	32	2.0	1	85.00			
	学位论文写作	32	2.0	1	85.00			
	非学位课小计		6.0					

学位（学术）委员会意见	通过	答辩委员会决议	
论文答辩时间		论文答辩地点	
备注			



全国大学英语六级考试
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总分： 469 具备英语六级口试报考资格

听力 (35%)	阅读 (35%)	写作和翻译 (30%)
148	181	140

成绩单编号：152214002001647

教育部考试中心

证书专用章

Applied Polymer Science

Fabrication and characterization of poly(vinylidene fluoride)-polytetrafluoroethylene composite membrane for CO_2 absorption in gas–liquid contacting process

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ABSTRACT: The wetting resistance of polytetrafluoroethylene (PTFE) membrane is a critical factor which determines the carbon dioxide (CO_2) absorption performance of the gas–liquid membrane contactor. In this study, the composite PVDF-polytetrafluoroethylene (PVDF-PTFE) hollow fiber membranes were fabricated through dry-jet wet phase inversion method by dispersing PTFE nanoparticles into PVDF solution and adopting phosphoric acid as nonsolvent additive. Compared with the PVDF membrane, the composite membranes presented higher CO_2 absorption flux due to their higher effective surface porosity and surface hydrophobicity. The composite membrane with additive of 5 wt % PTFE in the dope gained the optimum CO_2 absorption flux of 3.84×10^{-3} and 2.03×10^{-3} mol m^{-2} s^{-1} at an inlet gas (CO_2/N_2, = 1/4) flow rate of 100 mL min^{-1} by using distilled water and aqueous diethanolamine solution, respectively. Moreover, the 5 wt % PTFE membrane showed better long-term stability than the PVDF membrane regardless of different types of absorbent, indicating the polymer blending demonstrates great potential for gas separation. © 2016 Wiley Periodicals, Inc. J. Appl. Polym. Sci. 2016, 133, 43767.

KEYWORDS: carbon dioxide absorption; membrane contactor; PVDF-PTFE composite membrane; wetting resistance

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DOI: 10.1002/app.43767

INTRODUCTION

Carbon dioxide (CO_2) is considered to be one of the major greenhouse gases that cause global climate change and ocean acidification.[1] Among the sources of CO_2 emissions, fossil fuel-fired power plants are the largest fixed sources.[2] Therefore, post-combustion CO_2 capture from power plants has attracted considerable research interests. Among a wide variety of technologies that have been applied for post-combustion CO_2 capture, absorption is relatively efficient and developed.[3,4] However, conventional absorption method faces some difficulties such as sizeable energy consumption and operational problems.[5] Membrane contactor absorption technology is a promising alternative to overcome traditional absorption from the standpoint of process intensification.[6,7]

The separation mechanism of membrane contact absorption technology is different from gas permeation separation technology. In the gas–liquid membrane contact process, the porous membrane only acts as a contact medium between the gas and liquid phases, while the role of selectivity is fulfilled by liquid absorbents via physical absorption, chemical reaction, or a combination of these two processes.[8] During the operation process, gas and liquid absorbent flow on the different sides (shell side or lumen side) of hollow fiber membranes, and the separation occurs at the mouths of membrane pore on the liquid side. If membrane pores are wetted by the absorbent, mass transfer resistances will increase significantly due to low diffusivity of the gas in the liquid phase, thus leading to deterioration of membrane performance.[9–11] Therefore, to obtain high CO_2 absorption flux in the gas–liquid membrane contact process, wetting degree of the membrane is required to be as small as possible.

CO_2 absorption flux would increase through improving membrane wetting resistance. Wetting resistance of a membrane depends on its microstructure and hydrophobicity of the surface that contact the liquid. Hydrophobic surface, smaller pores, and sponge-like structures are desired for preventing liquids from penetrating the membranes. Many efforts have been made to improve the wetting resistance of hollow fiber membranes, such as the introduction of nonwetting solutions into the polymer dope.[12–17] Incorporating nonwetting solutions into the polymer dope can modify its physicochemical properties. Accordingly, the thermodynamic and kinetic properties of the polymer solution

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FEDERAL MINISTRY OF INDUSTRY, TRADE AND INVESTMENT
COMMERCIAL LAW DEPARTMENT
PATENTS AND DESIGNS ACT CAP 344, LFN 1990

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TRANSACTION AMOUNT	[illegible]	FILING TIME	
PATENT INFORMATION			
APPLICATION TYPE	Patent	PATENT TYPE	CONVENTIONAL
TITLE OF PATENT			
CHLORELLA EXPANDING CULTURE DEVICE			
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考试时间：2021年6月

总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
427	161	145	121

口　试

准考证号：--

考试时间：--

等级	--

成绩报告单编号：211153006001015

教育部考试中心

证书专用章

校验码：6Z0P C8S8 K3R8 BH1E

Contents lists available at ScienceDirect

Corrosion Science

journal homepage: www.elsevier.com/locate/corsci

Synergistic inhibition effect of *Mikania micrantha* extract with potassium iodide on the corrosion of cold rolled steel in methanesulfonic acid solution

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ARTICLE INFO

Keywords:
Cold rolled steel
Mikania micrantha extract
Green inhibitor
Electrochemical measurements
Surface characterization

ABSTRACT

The synergistic inhibition effect of *Mikania micrantha* extract (MME) with KI solution on the corrosion of cold rolled steel (CRS) in methanesulfonic acid (MSA) was evaluated by weight loss, electrochemical techniques and surface characterization. The experimental results indicate that either MME or KI performs moderate inhibitance with a maximum inhibition efficiency below 74%. However, MME/KI mixture exhibits an efficient performance with a maximum inhibition efficiency of 91%. There is a synergistic between MME and KI with a corresponding synergism parameter higher than 1. The plant extracts would can be developed as a novel inhibitor against metallic corrosion.

1. Introduction

Metallic corrosion is considered as a major issue in economics and safety. Based on NACE's report in 2016, the corrosion accounts for 3.4% of the global GDP, which is equivalent to 2.5 trillion USD [1]. One of the most popular methods of preventing metallic corrosion is the addition of the inhibitor in aggressive media. Along with the increasing concept of green development and environmental protection, the research of eco-compatible and biodegradable inhibitors has attracted more and more attentions all over the world [2–5]. As practice, green inhibitors must fulfill such requirements of biodegradable, and zero or minimal aromaticity [6].

Plant extracts can well satisfy the above-mentioned requirements of green inhibitors. More importantly of all, plant resources are so widely and easily available that the plant extracts are of low cost. Accordingly, plant extract as the corrosion inhibitor is a hot topic in the field of metallic corrosion and protection [7–9]. Up to now, many plant extracts have also tested as efficient inhibitors for steel in HCl and H_2SO_4 media, such as betel leaf [7], bagasse seeds and bagasse peel [8], Avocado (*Persea americana* seeds [9], Eucalyptus camaldulensis [10], Ficus (*Ficus benjamina* seeds Cedrus leaves [11], *Piper nigrum* [12], *Boswellia Dalz Palm* [13], *Artemisia argyi* [14], Agnimanth (*Vitex negundo*) [15], Ramsonsulfur (*Allium ursinum*) [16], Cabbage [17], *Bothriochloa ischcemum* [18], *Polygonum glabrum* [19] and Ortanque leaf(*Citrus aurantium*) [20]. The inhibitive action of plant extracts can be attributed to the active components of tannins, alkaloids, flavonoids, amino acids, alkaloid and sugars. These organic compounds are rich in polar atoms of N and O, electronegative groups as well as conjugated double bonds, which can actively adsorb on steel/acid interfaces, and then retard the corrosion of metallic surface by the aggressive media.

Since 2008, our work team has been doing water-soluble plant-based inhibitors against steel corrosion including bamboo leaves [21], Ginkgo [22], *Jasminum nudiflorum* Lindl. [23] and walnut green husk [24]. Recently, the alien invasive plants have become a major problem in local ecosystem. In order to achieve the goal of "making harm to treasure", our multi-team develops the novel idea that alien invasive plants can be extracted as the corrosion inhibitor. As one of the 100 worst alien species as well as one of the 10 worst invasive species in Southeast and South Asia [25], *Mikania micrantha* (MM) is omnipresent in southern area of China owing to its high growth and spread rates. It poses a huge threat to the ecology of local farmland and forests, and causes serious economic damage to affected areas. In our previous research, *Mikania micrantha* extract (MME) has been tested as the corrosion inhibitor for cold rolled steel (CRS) in CH_3CH_2OH [26] and H_2SO_4 [27]. However, the effective components in MME is still unclear.

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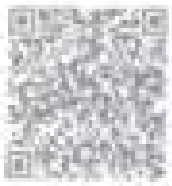
西南林业大学研究生成绩单



IELTS

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ACADEMIC

NOTE

Centre Number: AU099 | Date: 16DEC2019 | Candidate Number: 000005

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Family Name: [redacted]

First Name: [redacted]

Candidate ID: [redacted]

Date of Birth: 16/02/1999 | Sex (M/F): F | Scheme Code: Private Candidate

Country or Region of Origin:

Country of Nationality: CHINA (PEOPLE'S REPUBLIC OF)

First Language: CHINESE

Test Results

Listening	Reading	Writing	Speaking	Overall Band Score	CEFR Level
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Article

Highly Effective and Broad-Spectrum Antimicrobial Quaternary Ammonium Salts Containing Camphene Structure: Preparation, Surface-Active Properties, and Bioassay

Yanqun Huang, Shangchao Huo, Jianming Mo, and Daozhan Huang*

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ABSTRACT: A series of novel quaternary ammonium salts (QASs) (4a−4n) comprising a camphene moiety were synthesized for the first time. Fourteen examples were prepared from camphene through Prins reaction, halogenation, and quaternization, successively. The structures of the synthesized QASs were analyzed by Fourier transform infrared spectroscopy, ¹H NMR, ¹³C NMR and high-resolution mass spectrometry. Surface-active properties, emulsifying abilities, and foaming properties of the investigated compounds were then studied. The antimicrobial activities of these QASs against Gram-positive bacteria (Staphylococcus aureus and Bacillus subtilis), Gram-negative bacteria (Escherichia coli and Klebsiella pneumoniae), and fungi species (Candida albicans, Candida tropicalis, and Aspergillus niger) were determined by the microdilution method. The results showed that the chemical structural factors, including types of substituents and alkyl chain length, might be correlated with the lipid−water partition coefficient (Log P), which played a critical role in the antimicrobial process. Compounds with alkyl chain lengths (N) in the range of 10−14 were relatively more active, while compounds bearing pyridinium, benzyl, methylimidazolium groups, or varied alkyl chain lengths (N < 8 and N > 16) were almost inactive. Compound 4k possessing a dodecyl group exhibited the most effective and broad-spectrum antimicrobial activity against almost all tested bacteria and fungi with the minimal inhibitory concentration values ranging from 0.24 to 0.98 μg/mL.

■ INTRODUCTION

Infectious diseases triggered by bacteria, viruses, and fungi emerge suddenly and spread quickly, posing an ongoing threat that could strike us at any time. In particular, an outbreak of pneumonia caused by a novel, highly contagious coronavirus has led to near one-sixth of global deaths in the past 3 years.[1] Under these circumstances, disinfectants are commonly used in hospitals, industries, and households, which play a pivotal role on epidemic prevention and control.[2] Quaternary ammonium salts (QASs) are one of the most favorable and effective classes of disinfectants due to their excellent antibacterial activity, relatively low toxicity, easy preparation, and low price.[3,4]

With the facilitating of research, the development of modern QASs has been in rapid progress over the past 3 decades. The types of cations have evolved from the simplest alkyl chain to diverse organic skeletons, and the change of the anions has also varied from halogen ions to other inorganic anions such as hydrogen sulfate, tetrafluoroborate, hexafluorophosphate, etc.[5−7] Moreover, the number of carbon chains present has upgraded from single-chain to double-chain QASs, and the number of positive charges present can be divided into mono-, bis- (gemini)-, and multi-QAS.[8,9] These led to the enhancement of broad-spectrum antimicrobial properties of the following developed QASs.

Unfortunately, the fight against infections still faces difficulties since the widespread use of these QASs may induce environmental issues and the emergence of new strains of antimicrobial-resistant microorganisms.[10,11] For example, the results obtained by Amanghildlyeva and coworkers have shown that the most frequently used QASs, cetylpyridinium chloride (CPC) and benzalkonium chloride, were ineffective to a number of strains, such as Pseudomonas aeruginosa and Staphylococcus spp.[12] Besides, it has been reported that benzalkonium chloride has significantly low antimicrobial action against Escherichia coli and P. aeruginosa, with the minimal inhibitory concentration (MIC) over 1 μg/mL.[13−15] To handle these problems, enhanced QASs capable of killing bacteria effectively and moderately are encouraged.

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Chem. Biodiversity

Carane-3,4-diol Derivatives as Potential Water-Based Herbicides

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Abstract: Twelve novel carane-3,4-diol derivatives were designed, synthesized, and evaluated for their herbicidal activities against *Lolium multiflorum* Lam. and *Brassica campestris* for the first time. The relationships between chemical structural factors, including types, the number or the carbon chain length of functional groups, associated with the lipophilicity and herbicidal activities of the tested compounds were also discussed. The results showed that most of newly synthesized compounds had a dose-dependent, herbicidal activity against the root and shoot growths of *Lolium multiflorum* Lam. and *Brassica campestris*. Compared to carane-3,4-diol, most of the target derivatives possessed improved lipophilicity and certain solubilities in representative solvents with different polarities. Particularly, ester derivatives **3e**-**3k** and **3o**-**3r** can be dissolved or dispersed in water, but also displayed higher herbicidal activity against *Lolium multiflorum* Lam. and *Brassica campestris* than other ester derivatives. The 50% inhibitory concentration (IC_{50}) value of compound **3e** against shoot growth of *Brassica campestris* (I) was superior to that of commercial herbicide glyphosate (1.14 mmol/L), indicating that the potential application as a water-based herbicide for *Brassica campestris* control.

Keywords: carane-3,4-diol • ester and ether derivatives • herbicidal activity • water-based herbicides

Introduction

Herbicides have long been used as an effective tool to control weeds and enhance global crop productivity.[1] Despite the fact that traditional synthetic herbicides have made considerable progress in agriculture during recent decades, their extensive and inappropriate use also led to various problems related to human health and the environment.[2,3] For example toxicological effects caused by residues would pose a threat on the environment and living organisms.[4,5] Moreover, the development of resistance of weeds to these synthetic chemicals often foster concerns regarding the sustainability of current crop protection practices.[6,7] Furthermore, a wide range of classical herbicidal formulations, such as dust, emulsifiable concentrates and wettable powder, used in developing countries are associated with environmental pollution.[8,9] With the increasing awareness of potential harmful effects of conventional formulations, the development of water-based liquid formulations is of great importance because of relatively low cost, high concentration of insoluble active ingredients and ease of handling and application.[9] Therefore, eco-friendly alternatives to synthetic herbicides, such as botanical herbicides and their water-based liquid formulations with excellent activity and limited risk, are highly encouraged.

Monoterpenoid alcohols have attracted much attention in the development of novel agrochemicals because of their amphiphilic molecular structure and broad biological activities.[10–15] In particular, *p*-menthane-3,8-diol, *p*-menthane-1,8-diol and *p*-menthane-1,2,4-triol, known as *p*-menthane type monoterpenoid alcohols incorporating two or more hydrophilic hydroxyl groups, have been reported to act as potential water-based herbicides with excellent herbicidal activities for better development of sustainable agriculture.[16,17] In addition, these compounds are favored by many researchers due to their adjustable hydrophilic-lipophilic property and biosynthesis, which can be endowed with enhanced performance through chemical modification.[18,19] Similarly, (1*S*,3*R*,4*R*,6*S*)-3,7,7-trimethylbicyclo[4.1.0]heptane-3,4-diol (compound **3**), namely carane-3,4-diol, comprising one oleophilic carane structure and two hydrophilic hydroxyl functional groups, is also a monoterpenoid alcohol. Extensive research has shown that this compound has lots of advantages, such as good mosquito-repellent capability, low mammalian toxicity, environmental friendliness as well as cheap, making it significant in the development of green chemical pesticides.[20–22] Apart from this, recent evidence from our group indicated that compound **3** displayed higher herbicidal activity against annual ryegrass (*Lolium multiflorum* Lam.) and rape (*Brassica*

Student Number [illegible] 17 December 2019

[illegible]

THE UNIVERSITY OF MELBOURNE

ACADEMIC TRANSCRIPT

Completion and Conferral Summary

Master of Science (Chemistry)

Completed [illegible] 2019. Conferred [illegible] Dec 2019

Master of Science (Chemistry)

Year	Code	Title	Points	Mark	Grade
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Chemistry Research Project Pt 1	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible] Chemistry	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible] & NMR Structural Techniques	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Chemistry Research Project Pt 2	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Advanced [illegible] & Characterisation	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Chemistry Research Project Pt 3	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Chemistry Research Project Pt 4	[illegible]	[illegible]	[illegible]

Weighted Average Mark for this course [illegible]

End Of Transcript

[illegible]

[illegible]

此件与原件相符 [illegible]

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Grade	Mark	Explanation
HD	80 - 100%	First Class Honours
DN1	75 - 79%	Second Class Honours Division A
DN2	70 - 74%	Second Class Honours Division B
CR	65 - 69%	Third Class Honours
P	50 - 64%	Pass
N	0 - 49%	Fail
NH	40%	Not Considered Fail. Used when a student fails because they have not satisfactorily completed all prescribed (hurdle) requirements and would otherwise have passed the subject.
PL	-	Pass. Used for subjects marked on a pass/fail basis.
CMP	-	Completed. Only used for subjects marked on a pass/fail basis. CMP denotes that the subject was passed.
CNT	-	Continuing. Used for subjects that run over more than one teaching period where the subject has not been completed.
CTC	Refer to the explanation	Continuing - Completed. Used for each teaching period (except the final teaching period) where a student has been enrolled in and passed a continuing subject. When the subject is completed, for subjects that are not marked on a pass/fail basis, a mark (TC) will also be recorded against each enrolment in the subject.
CNF	Refer to the explanation	Continuing - Fail. Used for each teaching period (except the final teaching period) where a student has been enrolled in and failed a continuing subject. When the subject is completed, for subjects that are not marked on a pass/fail basis, a mark (TC) will also be recorded against each enrolment in the subject.
WD	-	Withdrawn from the subject after the date for making subject changes without penalty has passed.
NA	-	Not Assessed. Used for subjects that are non-assessable, such as Community Access Program audit studies.
GNS	-	Grade Not Submitted. Denotes that the assessment has not yet been finalised.
-	-	Denotes that a result is not applicable to the subject or that a result is unavailable.

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A. Successful completion of Honours courses usually requires a minimum grade of HD.

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C. Grading schemes for institutions that have now become part of the University (amalgamated institutions) for example: Melbourne Education (including Melbourne Teacher's College and Hawthorn Institute of Education), the Victorian College of the Arts, the Victorian College of Agriculture and Horticulture and The University of Melbourne TAFE can be accessed at http://grading.schemes.unimelb.edu.au/.

全国大学英语六级考试
成绩报告单

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学　　校：云南大学
院　　系：软件学院
身份证号：[redacted]

笔　试

准考证号：530015171208319
考试时间：2017年6月

总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
438	137	174	127

口　试

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等级	--

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云南省科学技术奖励

证　书

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奖励类别：科学技术进步奖

项目名称：基于区块链的普洱茶智慧溯源技术研发及应用

奖励等级：三等

获 奖 者：黄宇翔

云南省人民政府

2023年06月28日

证书号：2022JC009-R-004

梁希林业科学技术奖
科技进步奖

证 书

为表彰梁希林业科学技术奖获得者，特颁发此证书。

项目名称：基于区块链技术的普洱茶智能溯源及产业数字化应用

奖励等级：二等

获 奖 者：黄宇翔

2023 年 4 月 23 日

证书号：2022-KJJ-2-58-R04


发明专利证书
发明名称：
发明人：
专利号：
专利申请日：
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地址：
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局长
申长雨

发明专利证书

发明名称：一种基于区块链的跨境贸易数据可信存储方法

发明人：[redacted]

专利号：ZL 2022 1 [redacted].1

专利申请日：2022年03月15日

专利权人：西南林业大学

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第1页(共2页)

第45卷 第5期 计 算 机 工 程 2019年5月
Vol.45 No.5 Computer Engineering May 2019
·区块链专题· [illegible]

面向学分银行的区块链学习成果管控模型

[illegible]

摘 要：[illegible]

关键词：[illegible]

中文引用格式：[illegible]

英文引用格式：[illegible] Computer Engineering,2019,45(5):[illegible]

Management and Control Model of Blockchain Learning Result for Credit Bank

HUANG [illegible], LIANG [illegible], ZHANG [illegible], WEI [illegible]

[illegible]

【Abstract】[illegible]

【Key words】[illegible]
DOI:[illegible]

0 概述

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基金项目：[illegible]
作者简介：[illegible]

[illegible]

应用于供应链的区块链PBFT共识算法优化[①]

[illegible]

摘　要: [illegible]

关键词: [illegible]

[illegible]

Optimization of Blockchain PBFT Consensus Algorithm for Supply Chain

HUANG Yu-Xiang[1,2]

[1](School of Big Data and Artificial Intelligence, Southwest Forestry University, Kunming 650224, China)
[2](Key Laboratory of State Forestry and Grassland Administration on Forestry and Ecological Big Data, Southwest Forestry University, Kunming 650224, China)

Abstract: Currently, the application of blockchain in the supply chain is receiving increasing attention from the industry. However, due to the presence of a large number of complex transactions in the supply chain, selecting trustworthy primary nodes poses a challenge. Therefore, based on the machine learning classification algorithms and PBFT (practical Byzantine fault tolerance), this study proposes a blockchain PBFT optimization method applied to the supply chain. The integrated framework for the supply chain and blockchain is analyzed, and K-nearest neighbors (K-NN) is applied to optimize the primary node selection rules of the PBFT consensus algorithm based on the features of participating nodes in the supply chain consortium. Experimental results show that trust evaluation classification of consensus nodes can effectively address security issues caused by view switching, thereby improving the consensus performance of blockchain in terms of throughput, latency, fault tolerance, and other aspects. The proposed method is practical and provides ideas for the application of blockchain in other industries.

Key words: blockchain; practical Byzantine fault tolerance (PBFT); supply chain; K-nearest neighbors (KNN); trust evaluation

① [illegible]

云南大学研究生成绩通知单

[illegible] [illegible] [illegible]

[illegible] [illegible] [illegible]

序号	课程名称	课程性质	学分	成绩	考核结果
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2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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序号	课程名称	课程性质	学分	成绩	考核结果
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10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]					
序号	课程名称	课程性质	学分	成绩	考核结果
1					
[illegible]					

全国大学英语六级考试(CET6)成绩详情

姓　　名：李沁

证件号码：[redacted]

学　　校：上海海洋大学

准考证号：310151111202506

总　　分：439

听　　力：141

阅　　读：183

综　　合：39

写作和翻译：76

考试时间：2011年06月

成绩报告单编号：111231015003541

云南省科学技术奖励

证　书

为表彰云南省科学技术奖获得者，特颁发此证书。

奖励类别：科学技术进步奖

项目名称：珠水产业关键技术创新与应用

奖励等级：一等

获 奖 者：李灿

2020年06月30日

证书号：2019AC013-R-009

梁希林业科学技术奖
科技进步奖

证 书

为表彰梁希林业科学技术奖获得者，特颁发此证书。

项目名称：绿水资源培育及高效利用关键技术创新与应用

奖励等级：三等

获 奖 者：李凡

证书号：2019-KJJ-3-18-R05

计划类别：[illegible]

项目编号：[illegible]

云南省科技计划项目任务书

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承担单位：[illegible]

参加（合作）单位：

主管部门：

项目负责人：[illegible]　电话：[illegible]

起止年限：2016年10月至2019年09月

填表日期：2016年11月22日

云南省科学技术厅

李 云,龙 琴,杨 玉等. 辣木叶低极性组分的分离纯化和 GC-MS 分析[J]. 江苏农业科学,2020,48(20):259-263.
doi:10.15889/j.issn.1002-1302.2020.20.044

辣木叶低极性组分的分离纯化和 GC-MS 分析

李 云[1],龙 琴[1],杨 玉[1],张诗艺[1],杨小辉[2]
(1.云南农业大学热带作物学院,云南普洱 665099;2.云南农业大学农学与生物技术学院,云南昆明 650201)

摘要:为分析辣木低极性组分的组成,采用硅胶柱层析法,薄层色谱分析法对其进行检测并合并相似组分,再经甲醇-丙酮重结晶法分离得到白色晶体,GC-MS 分析鉴定出 6 个物质,分别已经确定种类,最后测定 β-谷甾醇,证明辣木叶含有 β-谷甾醇,这种物质具有很好的药用价值,为辣木叶的广泛利用,资源开发和药用提供合理的参考依据。

关键词:辣木叶;低极性组分;分离纯化;GC-MS 分析;甲醇-丙酮重结晶;植物甾醇;β-谷甾醇

中图分类号:S794　　**文献标志码**:A　　**文章编号**:1002-1302(2020)20-0259-05

辣木(*Moringa oleifera* Lam.)原产印度北部,为辣木科辣木属多年生乔木,全球共计 14 个种[1],目前广泛在云南种植生长,分布广泛耐旱耐贫瘠的速生树木,平均大型马利颗粒状种植面积

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现辣木的记载:印度人民有悠久的种植和食用辣木的记载,现已开发到,印度和中东两地的 80 多个国家,目前联合国粮农组织广泛种植[3],2015 年 11 月,我国卫生部已将辣木列为新资源食品名录,2014 年 7 月,习近平总书记将辣木种子作为国礼赠送给巴基斯坦前领导人扎尔达尔·贝斯特罗,这让更多的国人知道并开始了解这一种奇妙植物,云南省是我国辣木引进种植及科学研究的地区,目前全国种植面积约 4 000 hm^2,其中云南约 2 800 hm^2,大规模种植面积约 999 hm^2,广西、福建、广东、重庆、四川、海南等地均有种植[4],现代社会生活节奏加快,工作压力加大,越来越多人们健康意识的不断增强,

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Effects of ultrasonic assisted high-temperature cooking method on the physicochemical structure characteristics and *in vitro* antioxidant capacities of dietary fiber from *Dendrocalamus hamiltonii* Munro shoots

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ABSTRACT

In this study, the ultrasonic assisted high-temperature cooking extraction method of soluble dietary fiber from bamboo shoots was optimized by response surface methodology, and the effects of ultrasonic assisted high-temperature cooking extraction on the structural characteristics, physicochemical properties and antioxidant activity of soluble dietary fiber (SDF) from bamboo shoots were evaluated. The yield of modified SDF(MSDF) was significantly higher than that of untreated SDF(USDF). FTIR and XRD analysis indicated that MSDF had more hydrophilic groups and higher crystallinity (36.31 %), resulting in better thermal stability. SEM observations showed that MSDF exhibited a more loose microstructure, and the particle size of MSDF (695.32 μm) was significantly smaller than that of USDF (742.33 μm). In addition, MSDF had a larger specific surface area. In addition, MSDF has stronger water holding capacity, water swelling capacity, and oil holding capacity than USDF. The DPPH radical and hydroxyl radical scavenging rates of MSDF were 8.91 % and 7.49 % higher than those of USDF. In addition, the reducing ability of MSDF was higher than that of USDF, which had better antioxidant activity. In summary, MSDF has the potential to be developed as an antioxidant functional food.

1. Introduction

Bamboo shoots have attracted wide attention from many researchers at China and abroad because of their fast growth and rich nutrition. Various bamboo shoots are rich in vitamins, among which bamboo shoots are rich in dietary fiber, so they can be used as a promoted source of dietary fiber and provide a large amount of high-quality basic raw materials for the development of healthy food. *Dendrocalamus hamiltonii* is a bamboo plant of the genus *Dendrocalamus* of the family Gramineae. It is mainly distributed in the southwest part of Yunnan Province, China. It is a large arborescent bamboo for both shoots and timber. It has the advantages of good soil and water conservation and high economic value. Studies have shown that polysaccharides extracted from bamboo shoots by water or alkali exhibit strong antioxidant and immunomodulatory activities [1,2]. At the same time, bamboo shoot dietary fiber can also reduce hypertension, and prevent cardiovascular and other chronic diseases and cancer [3].

Dietary fiber can be divided into insoluble dietary fiber (IDF) and soluble dietary fiber (SDF) according to solubility. Compared with IDF, SDF has better solubility and viscosity, so it is easier to form gel, which has great potential in the field of health care and food processing industry [4–6], and compared with IDF, SDF has stronger antioxidant capacity. SDF also has a greater role in preventing physiological constipation, such as eliminating harmful heavy metal ions, promoting the intestinal microbial flora, reducing sodium, and fecal cholesterol levels, inhibiting postprandial blood glucose [7–9], preventing hypercholesterolemia and heart disease. Compared with other carbohydrates, dietary fiber has lower calories, longer digestion time and higher food chemical effect (calories compared to digest dietary fiber). high-fiber diets are generally lower in calories, larger in volume, and more nutritious, giving people a longer sense of satiety, thereby avoiding excessive eating that is harmful to body lose weight. It is believed that SDF in dietary fiber should reach more than 10% to be called high quality dietary fiber, so that the product has good expansibility and water holding capacity, to have strong

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[1] USDF: Ultrasound assisted soluble dietary fiber from *Dendrocalamus hamiltonii* Munro shoots for ultrasonic assisted high-temperature cooking method
[2] MSDF: Ultrasound assisted soluble dietary fiber from *Dendrocalamus hamiltonii* Munro shoots

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12	[illegible]	[illegible]	[illegible]	16	1	[illegible]	[illegible]	[illegible]
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14	[illegible]	[illegible]	[illegible]	16	1	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	16	1	[illegible]	[illegible]	[illegible]
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云南野生鸟类图像自动识别系统*

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摘　要：目前鸟类识别利用智慧生物和人工与经验积累，效率不高，为此，基于最新的人工智能技术利云南野生鸟类图像集，建立以云南省野生鸟类信息为核心，云南省野生鸟类视频管理子系统，云南省野生鸟类图像识别系统为平台和建云南野生鸟类图像自动识别系统。该系统是智慧的初步探索，为科学鸟类的保护提供数据，从而减轻人工智能智慧的困难和问题，该系统不仅能够准确识别鸟类种类，还能给出鸟类所属的概率和该鸟类资料及对应的链接，供人类、外国和处理相关问题参考，具有较好的实用价值。

关键词：深度学习；鸟类识别；图像识别

0　引言

云南省野生鸟类资源丰富有较大的观赏价值和经济价值，是世界野生鸟类的物种保护生存重要基地，目前个物种的丰富度超过总数，超过世界 云南野生鸟类分布区总种数 [1] 种，占世界种数的 [2]%，特有种 [3] 种，占 [4]%，国家级 [5] 种，占 [6]%，濒危种 [7] 种，占 [8]%，近危种 [9] 种，占 [10]%，易危种 [11] 种，占 [12]%，这说明云南野生鸟类生物资料是记录，但多数物种的种群数量较少，濒危物种，很多种类的生存条件过于脆弱，当每一区域的破坏超过临界点，就会导致物种的消失甚至灭绝，大类第一级保护物种，国家级 [13] 种，省级 [14] 种，占 [15]%，特有种 [16] 种，占 [17]%，濒危种 [18] 种，占 [19]%，近危种 [20] 种，占 [21]%，易危种 [22] 种，占 [23]%，这些物种，因为其数量少，种群小，栖息地破碎化，人为活动干扰，导致其生存受到威胁，甚至灭绝。

当前对于鸟类识别利用智慧和人工，效率不高，且对于一般的非专业人员来说不易区别不同种类的鸟类，当发现一只鸟类，不知道其名称是否属于保护鸟类，不知道其生存环境和食性等，因此，为了更好的保护鸟类，有效的区别鸟类，建立一个鸟类识别系统，是非常重要的，为此，基于最新的人工智能技术，建立以云南省野生鸟类为主的图像识别系统，该系统不仅能够准确识别鸟类种类，还能给出鸟类所属的概率和该鸟类资料及对应的链接，供人类、外国和处理相关问题参考，具有较好的实用价值。

1　云南野生鸟类图像识别系统

为了进行云南野生鸟类图像识别研究，首先要先收集了 [24] 种云南野生鸟类图像，对于每一幅图像进行了人工标注，形成建立云南野生鸟类图像数据库，并在云南野生鸟类图像数据进行管理，通过基于图像识别的神经网络特征提取，建立一种高效准确的鸟类图像识别模型，并基于这个模型构建云南野生鸟类图像智能识别系统。

1.1　云南野生鸟类图像数据集

目前在鸟类图像识别研究使用的数据集主要是来源于网络和实地工作现场拍摄的数据集 [25,26,27]，这些数据主要以北美鸟类为主，主要缺乏亚洲鸟类的数据，中国与亚洲鸟类区系成员 [28] 以其亚洲鸟类数据为核心的主要研究区域。截 [29] 至鸟类名录 [30] 记录 [31] 云南共记录鸟类 [32] 种，占 [33]% 中国总种 [34]，其 [35] 占 [36]%，其中国记录鸟类物种数量多的地区。本课题建了 [37] 种云南野生鸟类总的图像，涉及 [38] 个目，[39] 个科，[40] 个属，其中雀形目 [41] 种，占总量的 [42]%；鸻形目 [43] 种，占总量的 [44]%；每个类别包含 [45] 幅图像，共计 [46] 幅图像，类别数量鸟类的分布情况，详见表 [47]，涵盖、科属、属名称、拉丁文名、科别特征、颜色特征、地理分布 [48] 个不同维度的数据分布情况。从此为基础，建建立有关鸟类视频识别数据集，该数据集建设标准为 T/CSAE 53—2020，云南数据集每个类别中随机选取一幅图像数据组成的图像数据集 [49]，如表。

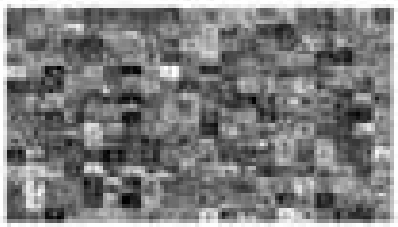

图 [50]　云南野生鸟类图像数据集

由于现有数据集的种类和数量不能用于对云南鸟类进行识别，所以需要收集和制作新的数据集，为了能够对云南野生鸟类图像进行识别和管理，为数据集提供技术基础，对云南野生鸟类图像进行人工标注处理，如图 [51] 所示，云南野生鸟类图像数据集中的每一幅鸟类图像都提供以下标注信息：类别标签，图像的标签包括图像名称，鸟类的标签包括图像名称，每个标签包括类别名称，对象标签。

图 [52]　云南野生鸟类图像标注

1.2　云南野生鸟类检测数据子系统

本系统开发环境是基于的鸟类图像的数据上，选择云南地

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A Research on the Sharing Platform of Wild Bird Data in Yunnan Province Based on Blockchain and Interstellar File System

Huaiyuan Yang †, Yucheng Li †, Hua Zhou *, Yili Zhao and Lei Song

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Abstract: Sharing scientific data is an effective means to rationally exploit scientific data and is vital to promote the development of the industrial chain and improve the level of science and technology. In recent years, the popularity of the open data platform has increased, but problems remain, including imperfect system architecture, unsecured privacy and security, and non-standardized interaction data. To address these problems, the blockchain's decentralization, smart contracts, distributed storage, and other features can be used as the core technology for open data systems. This paper addresses the problems of opening, allocation-right confirmation, sharing, and rational use of wild bird data from Yunnan Province, China. A data storage model is proposed based on the blockchain and interstellar file system and is applied to wild bird data to overcome the mutual distrust between ornithology institutions in the collaborative processing and data storage of bird data. The model provides secure storage and secure access control of bird data in the cloud, thereby ensuring the decentralized and secure storage of wild bird data for multiple research institutions.

Keywords: blockchain; bird big data; interplanetary file system; data sharing

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1. Introduction

With the development of artificial intelligence, cloud computing, quantum computing, and blockchain technology, we have entered the era of big data, which is now growing at an unprecedented rate. The results of big-data research are subtly infiltrating all aspects of social economy and daily life and are gradually becoming a growth point of development and innovation. Big data thus plays an increasingly important role in people's daily life and work [1–3]. At present, big data affects all walks of life. For example, the medical field uses doctor–patient data to establish a patient privacy model [4,5]; the financial sector uses market data to analyze market trends [6]. Remote-sensing data are used to analyze the degree of economic prosperity [7], and the agricultural sector uses weather data to predict yields for the coming year [8,9]. The value of data is being increasingly tapped, bringing economic and social benefits.

The exploitation of big data initially lacked authoritative standards and guidance for the processing, measurement standards, and applications of data produced by different scientific institutions. For data on wild birds from Yunnan Province, China, few application programming interfaces (APIs) offer services, which prevents the public and scientific research institutions from optimally mining these data through an open data mining system, thereby curtailing our ability to protect wild birds in Yunnan Province. Thus, the supply of bird-data services lags behind the demand.

Scientific institutions are concerned about security risks, such as data leakage and tampering and user-operation traces [10,11], which is a key factor limiting the sharing of wild-bird data. The cloud data encryption technologies commonly used by most scientific institutions, such as RSA, digital certificate, and the HTTPS protocol, all suffer from data

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Chemical Engineering Journal [illegible]

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Chemical Engineering Journal

journal homepage: [illegible]

Optimization of durable superhydrophobic wood with superstrong ultraviolet resistance and chemical stability

Qian Liu [a,b,1], Baiyu Wang [a,b,1], Haiqiu Jiang [a,b], Quanxiong Lu [a,b], Lingfeng Wang [a,b], Yang Yang [a,b], Ruifeng Cheng [a,b], Qiang Gao [c], Long Yang [a,b], Guanben Du [a,b], Wei Gao [a,b,*]

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ARTICLE INFO

Keywords:
[illegible]
Wood
Spraying method
Superhydrophobicity
Chemical and mechanical durability
Super-strong ultraviolet resistance

ABSTRACT

The low UV durability and weak chemical stability of superhydrophobic wood limited its wide application. [illegible] nano particles, epoxy (EP), vinyltriethoxysilane (VTES) and room temperature vulcanized silicone rubber (RTV) were combined together to modify both soft and hard wood with function of superhydrophobic [illegible] successfully. The modified wood was endowed not only superhydrophobicity as expected, such as CA more than 150°, along with anti-fouling and self-cleaning properties, but also excellent durability, including [illegible] chemical, acid/alkaline, abrasion, water impact and tape peeling stability. Most prominently, there was almost no color changing being observed on the modified samples. Furthermore, the best UV resistance, [illegible] consecutively against UV irradiation, was achieved in the field of wood superhydrophobic modification. The proposed [illegible] protective mechanism by [illegible] has potential to extend the service life and improve the high value utilization of wood product.

西南林业大学研究生成绩单

姓名	[illegible]	性别	[illegible]	出生年月	[illegible]	学号	[illegible]
学科专业	[illegible]			指导教师	[illegible]		
入学年月	[illegible]	毕业年月		[illegible]		学制	[illegible]

类别	课程名称	学时数	学分	修读学期	成绩	备注
学位课	[illegible]	32	2.0	1	[illegible]	[illegible]
	[illegible]	32	2.0	1	[illegible]	[illegible]
	[illegible]	32	2.0	1	[illegible]	[illegible]
	[illegible]	32	2.0	1	[illegible]	[illegible]
	[illegible]	36	2.0	1	[illegible]	[illegible]
	[illegible]	64	3.0	1	[illegible]	[illegible]
	[illegible]	16	1.0	1	[illegible]	[illegible]
	[illegible]	32	2.0	1	[illegible]	[illegible]
	[illegible]	32	2.0	1	[illegible]	[illegible]
	学分小计		18.0			
非学位课	[illegible]	32	2.0	[illegible]	[illegible]	[illegible]
	[illegible]	32	2.0	[illegible]	[illegible]	[illegible]
	[illegible]	32	2.0	[illegible]	[illegible]	[illegible]
	学分小计		6.0			
学位（毕业）论文题目	[illegible]					
论文答辩时间			论文答辩成绩			
备注						

西南林业大学研究生处 成绩专用章


10:18
4G
全国大学英语四、六级考试成
中国教育考试网
考试资讯
公告公示
考试项目
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姓　名
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西南林业大学
成绩报告单编号
211153006001008
笔试成绩
准考证号
530060211102223
总　分
440
听　力
139
阅　读
169
写作和翻译
132
口试成绩

Carbohydrate Polymers [illegible]

Contents lists available at [illegible]

Carbohydrate Polymers

journal homepage: [illegible]

Activated wood surface and functionalized cellulose co-building strong chemical wood bonding performance

Tongda Liu, Guanben Du, Yingchen Wu, Chang Liu, Hongxing Yang, Kelu Ni, Chunyan Yin, Xin Ran, Wei Gao, Long Yang

[illegible]

ARTICLE INFO

Keywords:
[illegible]

ABSTRACT

[illegible]

1. Introduction

Since ancient times, wood has been a sustainable material provided by nature with good mechanical strength and the advantages of a high strength-to-weight ratio and fast growth rate. With the development of society, wood and its derivatives have been widely used as building materials [illegible]. Wood adhesive is indispensable for the production of wood composite materials, such as furniture, flooring, and some load-bearing buildings. Urea-formaldehyde (UF) [illegible], phenol-formaldehyde (PF) [illegible], and melamine-formaldehyde (MF) [illegible] are the most widely used traditional formaldehyde-based adhesives due to their high curing speeds, low prices, and good adhesive performances. Nevertheless, they release formaldehyde, which can harm public health and pollute the environment, and they are produced from non-renewable fossil resources. With the improvement of people's quality of life, we must pay attention not only to the quality of products but also to human health. Therefore, the competitiveness of formaldehyde-based adhesives in the market will gradually decrease, and the development of natural and sustainable adhesives has attracted great interest [illegible]

[illegible]

[illegible]

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journal homepage: www.elsevier.com/locate/compositesb

Cellulose-based ultrastrong wood adhesive and composites constructed through "sandwich" profile bonding interface

Tongda Liu [a], Guanben Du [a,b,***], Hongqing Yang [a], Kelu Ni [a], Hang Su [a], Haozhang Wen [a], Byung-Dae Park [c], Xin Ran [a], Wei Gao [a], Mizi Fan [d,**], Long Yang [a,*]

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ARTICLE INFO

Handling Editor: Dr Alex Wang

Keywords:
Cellulose bio-adhesive
"Amine-epoxy-amine" sandwich interface
Crosslinking network bonding
Activated wood surface
Plywood composites

ABSTRACT

This present paper investigates the bonding interface between cellulose-based adhesive and chemically activated wood to explain the contribution of cohesive and interactive force between adhesive and substrate to the bonding properties. The activated wood surface with in $-NH_2$ groups is produced by breaking 3-amino-propyl triethoxysilane (APTES) on the natural wood. The amine-functionalized cellulose is made by grafting microcrystalline cellulose with APTES and the adhesive is developed by crosslinking the branched spermine with the aminated cellulose. Subsequently, a novel strong wood laminate is developed by inserting the $-NH_2$ groups on the activated wood surface reacted with the epoxy groups in the adhesive to construct an "amine-epoxy-amine" sandwich bonding interface. The bonding strength of laminates at dry condition and after hot and boiling water treatment is 4.04 MPa, 2.42 MPa and 1.64 MPa, respectively. The strength after boiling water treatment of the plywood laminates made of all-component adhesive enhanced from 0 MPa to 1.64 MPa contrasted with that made of pure saturated cellulose and also prepared from the activated wood surface enhanced from 0.77 MPa to 1.64 MPa contrasted with that made by the unactivated wood surface. The cohesion of the adhesive and the interaction force between the adhesive and the wood substrate played an important role in the bonding properties.

1. Introduction

Undoubtedly, adhesives play a very important role in many industrial sectors, e.g. manufacturing, medicine, aerospace and construction, and even daily life [1]. Practical applications include packaging, wound dressings [2–5], electrical appliances [6], sensors [7–9], aerospace [10], wood-based panels [11–14] and many others. Traditional adhesives for wood bonding composites are epoxy resins and formaldehyde-based resins, which are the most widely used because of their low cost, short curing time and good performance [15]. However, they mainly come from non-renewable petroleum resources, and the volatilization of formaldehyde and other volatile organic compounds could cause harm to human health and pollute the environment [16]. As people's living standard improves and the concept of sustainability is being practiced globally, the development of aldehyde-free bio-based adhesives has attracted great attention from many researchers.

Biomass-based wood adhesives possess environmentally friendly products that use renewable and biological organic resources as raw materials, e.g. lignin [17–21], tannin [22–24], soy protein [25–27], starch [28–30], sucrose [31–33], cellulose [34–36] and other

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学科专业	化学		指导教师	[illegible]			
入学年月	2020 年 09 月	毕业年月	2023 年 06 月		学制	3.0	

类别	课程名称	学时数	学分	开课学期	成绩	缓考成绩	补考成绩	重修成绩
学位课	高等有机化学	48	3.0	1	89			
	英语精读	72	1.5	1	84			
	英语精读	72	1.5	2	78			
	英语听力	36	0.5	1	84			
	英语听力	36	0.5	2	77			
	英语口语	36	0.5	1	73			
	英语写作	36	0.5	2	75			
	学位英语	8	0.0	2	69			
	中国特色社会主义理论与实践研究	36	2.0	2	77			
	自然辩证法概论	18	1.0	1	82			
	现代化学研究进展	32	2.0	1	81			
	现代仪器分析	32	2.0	1	87			
	专业英语	32	2.0	1	83			
	学位课小计		16.0					
非学位课	生物质资源化学与利用	32	2.0	1	94			
	化工分离技术	32	2.0	1	94			
	试验设计与数据处理	32	2.0	1	80			
	催化剂工程	32	2.0	1	84			
	非学位课小计		8.0					
学位（毕业）论文题目	[illegible]							
论文答辩时间	2023-05-21		论文答辩成绩		90.0			
备注								

审核人（签章） 学院（部）（盖章） 研究生院（盖章）

2023 年 [illegible] 月 [illegible] 日　2023 年 [illegible] 月 [illegible] 日　2023 年 [illegible] 月 [illegible] 日

大学英语四级考试
成绩报告单

CET®

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学　　校：三峡大学

院（系）：化学与生命科学学院

准考证号：420620112129708

身份证号：[redacted]

考试时间：2011 年 12 月

总分： 485

听力 (35%)	阅读 (35%)	综合 (10%)	写作和翻译 (20%)
147	206	43	89

成绩单编号：112142062001774

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Article

A New Strategy for Consumption of Functional Lipids from *Ericerus pela* (Chavannes): Study on Microcapsules and Effervescent Tablets Containing Insect Wax–Derived Policosanol

Yiwen Liu, Hong Zhang, Juan Xu, Rui He, Jinju Ma, Chiqing Chen and Lanxiang Liu

Special Issue
Edible Oils: Structure, Composition, Processing and Nutritional Properties
Edited by
Prof. Dr. Susana Ferreira Dias, Prof. Dr. Fatima Peres and Prof. Dr. Xuebing Xu

MDPI

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局长
申长雨

项目编号：2021BCE047

湖北省中央引导地方科技发展专项

任 务 书

项 目 名 称 抗病毒型单宁酶转生物合成关键技术开发与产业化

承 担 单 位 (盖公章)五峰赤诚生物科技股份有限公司

项 目 负 责 人 刘文敬

起 止 年 限 2021-07-01 至 2023-12-31

湖北省财政厅、湖北省科学技术厅

湖北省科学技术厅

2023年度湖北省科学技术奖拟奖项目公示

128	科学技术进步奖	面向时空大数据产业化支撑的多维数据可视化研究	赵千，张红梅，王学军，杨海波，吴晓燕，王正东，邓辉，崔大鹏，张文辉，陈曦，刘海燕，张新宇，李金宗，王国梁，甘；	湖北大学，主要完成单位创造性贡献如下：1、提出时空数据的多维特征表示方法，提高时空数据可视化效率；2、提出面向大尺度时空数据的多维可视化方法，实现时空数据多维度交互分析；3、提出面向多种智能终端的多维数据多维度交互方法，一种高效数据处理方法，支撑大规模时空数据可视化应用。主要完成人对本项目的创造性贡献排序合理，同意公示。	武昌首义	无异

三峡大学研究生课程成绩单

学　　号：2014113010004　　姓　　名：刘文超　　年　　级：2014级
院　　系：生物与制药学院　　专　　业：有机化学　　导　　师：李德江

课程类别	课程信息				
	课程编号	课程名称	总学时	学分	课程成绩（百分制）
专业学位课	Y0710011C	有机波谱分析	32	2	89
	Y0710013C	有机合成化学	32	2	87
	Y0710016C	分子设计与构效关系	32	2	85.5
	Y1210001C	专业外语（生态专业）	32	2	89
跨专业基础课	Y0710015D	现代仪器分析	32	2	91
基础学位课	Y0710012B	高等有机化学	32	2	85.4
	Y0730013B	天然有机化学	32	2	81
	Y0730014B	现代分离技术	32	2	82
公共学位课	Y1200001A	中国特色社会主义理论与实践研究	36	2	84
	Y1205002A	自然辩证法	18	1	87
公共基础课	Y1209001A	英语平读	32	1	75
	Y1209002A	英语写作	32	1	77.2
	Y1209003A	综合英语	64	2	68
专业选修课	Y0710013D	有机化学概论	32	2	87
	Y0710015D	有机合成工艺	32	2	84
公共选修课	Y1205004C	历史的人类	16	1	90

课程计划总学分：8.0　　已修总学分：28.0　　学位课平均成绩：86.6

三峡大学研究生院 制表

大学英语四级考试
成绩报告单

姓　　名：[illegible]

学　　校：青岛理工大学(A)

院（系）：土建工程

准考证号：[illegible]

身份证号：[redacted]

考试时间：　2014　年　12　月

总分： 436

听力	阅读	写作和翻译
135	165	136

成绩单编号：142137243002578

[illegible]

委托发布单位：全国大学[illegible]　[illegible]

[illegible]网站：[illegible]

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Chemical Engineering Journal

journal homepage: www.elsevier.com/locate/cej

Cross-linked entanglement of aldehyde and amine-functionalized nanocellulose reinforced with biomineralization to produce an all-bio-based adhesive

Kefu Ni [a,b], Guanben Du [a,b,c,*], Chuanyin Liu [a,b], Yingchen Wu [a,b], Hongxing Yang [a,b], Chunyan Yin [a,b], Hang Su [a,b], Xin Ran [a,b,d,*], Wei Gao [a,b], Long Yang [a,b,c,*]

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ARTICLE INFO

Keywords:
Cross-linked entanglement network
Nanocellulose
Biomineralization
Bio-based adhesive

ABSTRACT

Natural, biobased-up approaches for building high-performance adhesives remain challenging due to a lack of inadequate modifiers that can satisfy the robustness, solidness, and water resistance requirements. Therefore, the development of green and sustainable biomass adhesives is attractive but remains a challenge. In this study, we used the "take-from-wood, back-to-wood" concept, which was combined with the development of a new cellulose-based wood binder. First, dialdehyde-functionalized nanocellulose (DNC) and amine-functionalized nanocellulose (ANC) were successfully prepared from microcrystalline cellulose through oxidation and grafting reactions. Second, a rigid bio-inspired mineralized cellulose framework (ACaP@DNC) was constructed by using tetraethylenepentamine (TEPA) as a precursor to induce the in-situ growth and deposition of HCO_3^- via the sol-gel method on a cellulose template. Furthermore, an environmental-friendly rapid production method was achieved by mixing DNC and ACaP@DNC nanocellulose solutions to form a nacre-like cross-layered structure of DNC/ACaP@DNC, within TEPA as nano-reinforcement. DNC was considered to be the crosslinking phase, while ACaP@DNC played the role of the reinforcement (strengthening phase). The cellulose-based nanophysical network gained extensive through Schiff bonds, hydrazone bonds, hydrogen bonds, hydrophobic interactions, and metallophilic between the cellulose chains, leading to enhanced and toughened bonding properties. Dry and wet shear strengths of 2.09 and 1.26 MPa were achieved for the adhesive with a solid content of 10%. This new and sustainable strategy produced a biomimetic cellulose adhesive with a strong and stable crosslinked entanglement network, and also achieved high bonding performance.

1. Introduction

The quality of bonding and performance of wood adhesives depends mainly on the type and quality of the adhesive [1]. For many years, urea-formaldehyde resins [2], phenolic resins [3], and melamine-urea-formaldehyde resins [4] have shown obvious advantages in terms of performance, bonding process, and stability performance, and have occupied the majority of the market share. However, formaldehyde-based adhesives are derived from non-renewable petroleum resources and release harmful formaldehyde during the production and application processes. Continuous release of formaldehyde can cause the risk of cancer and other serious diseases [5,6], and with the depletion of petroleum resources and increasing awareness of human health, researchers are increasingly focusing on biobased adhesives as potential alternatives to commonly used formaldehyde-based adhesives [7].

Various biobased polymers have shown great potential as wood binders, including starch [8], plant proteins [9], tannins [10], chitosan [11], vegetable oils [12], lignin [13], and cellulose [14,15]. Among them, cellulose is the most abundant natural polymer on earth with the advantages of biodegradability, biocompatibility, and safety [16],

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ACS APPLIED MATERIALS & INTERFACES

Lobster-Inspired Chitosan-Derived Adhesives with a Biomimetic Design

Kefu Ni, Jiaojiao Yu, Gaurdeo Das,* Jiawei Qian, Hongpeng Yang, Jiajun Wang, Jianyong Wan, Xin Kan, Wei Gao, Zhijun Chen,* and Long Yang*

Cite This: ACS Appl. Mater. Interfaces 2019, 11, 1900−1909 | Read Online

ABSTRACT: Polysaccharide-based adhesives, especially chitosan (CS)-derived adhesives, serve as promising sustainable alternatives to traditional adhesives. However, most demonstrate a poor adhesive strength. Inspired by the inherent layered structure of marine arthropods (lobsters), a core−shell structure (SiO_2−NH_2@PDA) with amino-functionalized silica (SiO_2−NH_2) in the core and oxidized pyrogallol (OPG) in the shell is prepared in this study. The component is blended with CS to produce a structural biomimetic wood adhesive (SiO_2−NH_2@PDA/CS) with excellent performance. In addition to thermocompressive curing, the adhesive exhibits a water-evaporation-induced curing behavior at room temperature. With reference to the design mechanism of the lobster cuticle, this microphase-separated structure consists of clustered nanofibers with varying amounts of SiO_2−NH_2@PDA particles between the fibers. This intriguing microphase structure and its mechanical effects could offer experimental evidence for improving the functional modification of wood composites.

KEYWORDS: chitosan, core−shell structure, biomimetic, wood adhesive, photothermal chemistry, hydrothermal reaction

INTRODUCTION

Adhesives have a wide range of applications in forestry, construction, packaging, and other fields.[1,2] Commercial adhesives are typically based on petroleum resources and are not recyclable, resulting in environmental pollution and human health issues.[3,4] Biobased binders such as cellulose,[5,6] tannin,[7] lignin,[8,9] soy protein,[10,11] and chitosan (CS)[12,13] offer an environmentally technological alternative while also providing carbon materials.

Polysaccharides are macromolecular carbohydrates consisting of glycosidically linked sugar chains containing at least 10 or more monosaccharides. These molecules are widely distributed in nature, such as the components of plant and animal cell walls, as well as stored materials in plants and animals, and are widely employed as natural adhesives.[14,15] However, insufficient mechanical properties and water resistance have plagued polysaccharide-based adhesives.[16,17] Polysaccharide binders such as starch, cellulose, hemicellulose, chitin, and sodium alginate have been assessed to enhance the bonding performance of these binders using various strategies, including structural modifications[18,19] cross-linker modifications,[20] and macromolecular reactions[21,22] and covalent/nonconvalent cross-linking.[23]

Commonly developed polysaccharide-based wood binders contain complex physical and chemical modifications, and the mixing of multiple components complicates the preparations.[24] In addition, their bonding range has shown to be typically dependent on the specific curing temperature.[25] By contrast, nanocellulose has been reported to form reliable bonds simply by reducing evaporation at room temperature.[26,27] Compared to nanoscale nucleotides, acidic solutions serve as the simplest and most environmentally friendly solvents for dissolving CS[28,29] and have been widely used for bonding wood products. However, CS appears to lack surface energy properties that favor dense adhesion.[30] In general, adhesives with appropriate viscosity can be used for large-area applications such as laminating, filling, and long-area bonding.[31,32] However, the area of research has received minimal attention from the literature.

The combination of natural biomimetic structural design (e.g., pearl layers,[33] bone layers,[34,35] and arthropod cuticles[36]) using high-performance materials serves as an interesting strategy for the production of advanced functional materials. Among them, the hardening mechanism of arthropod cuticles has been applied to the field of adhesives.[37,38] However, certain challenges regarding the preparation process still need to be overcome [e.g., enzyme mediation during the in vitro conversion of phenol-to-benzoquinone, as the natural complex tanin (carbonate) in the cuticle will be unstable under acidic

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Colloids and Surfaces A: Physicochemical and Engineering Aspects

Developing sugar-based wood adhesives using Schiff base chemistry derived from carbohydrates

Wenxing Li [a,1], Chuanxiao Yang [a,1], Xiangyu Ren [a,1], Zhi Li [a], Hongxing Yang [a], Xu Zhang [a], Tonghua Huang [a], Xin Rao [a], Wei Gao [a], Kelu Ni [a,b,*], Guanben Du [a,b,*], Long Yang [a,b,*]

HIGHLIGHTS

GRAPHICAL ABSTRACT

ARTICLE INFO

ABSTRACT

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Full Length Article

Development of all-bio-based xylan adhesive: Simple preparation and excellent performance

Wenxing Li [a], Zhi Li [a], Guanben Du [a,b,*], Chunxiao Yang [a], Hang Su [a], Kefu Ni [a,*], Tongfa Liu [a], Xu Zhang [a], Xin Ran [a], Wei Gao [a], Long Yang [a,b,*]

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ARTICLE INFO

Keywords:
Cyanoethylated xylan
Aminated xylan
All-bio-based adhesive

ABSTRACT

Nowadays, the development of green wood adhesives with high bonding strength and waterproofing is still challenging due to the abundance of hydrophilic groups in biomass materials resulting in suboptimal properties. Herein, cyanoethylated xylan (CNX) and aminated xylan (AX) were prepared from xylan (X) through acrylonitrile and grafting reactions, respectively. Then, a high-performance xylan-based adhesive (CNX-AX) was prepared by directly crosslinking CNX and AX. The chemical structure of CNX-AX was analyzed by FTIR, ^{13}C NMR, and XPS. The results showed that the CNX-AX network crosslinked network increased cohesion through covalent bonds (C=N, N-C=N, and N-C=C bond), intermolecular hydrogen bonding as well as entanglement between xylan chains, which endowed the adhesive with excellent bonding properties. Compared with unmodified xylan (X), the wet bonding strength of CNX-AX at 70 °C for 3 h under hot-pressing conditions increased to 1.39 MPa (soaked in water at 63 °C for 3 h). This work provides a new strategy for the simple and efficient preparation of high-performance all-bio-based adhesives.

1. Introduction

In the past decades, traditional formaldehyde-based adhesives have been widely applied in furniture [1], construction [2], vehicles [3], and packaging industries [4] due to their high curing speeds, low prices, and good bonding properties. However, not only the raw materials of traditional adhesives are mainly from limited fossil resources, but also formaldehyde is a be released during preparation and use [5–8]. With the depletion of petroleum resources and the improvement of environmental awareness, the negative environmental impact of formaldehyde-based adhesives has gradually weakened [9,10].

Currently, raw materials derived from forests and agricultural biomass resources, such as tannins [11], starch [12], cellulose [13,14], and soy proteins [15], are remarkably renewable and biodegradable, and they display great potential for replacing traditional petroleum-based feeds and related synthetics. Hemicellulose is an abundant biomass resource in nature and it is found in the cell walls of almost all plant species [16,17]. Xylan is one of the most common hemicelluloses and it is composed of β-(1,4)-linked xylose residues, acetylated residues, and arabinose and 4-O-methylglucuronic acid [18]. The hydroxyl groups of the xylan ring structure allow it to be chemically and physically modified. Common chemical modification methods, such as graft copolymerization [19], esterification [20], etherification [21], are used to introduce reactive groups into the molecular structure of xylan in between its bioactivity and physical properties, which will lead to its application in the fields of biology, medicine, and materials, and to generate the corresponding economic value.

Xylan as a polysaccharide has a higher degree of polymerization than monosaccharide molecules such as glucose, which makes it more insoluble [22]. As researchers have become more and more concerned in xylan, more and more studies have been conducted on xylan modification. Previous studies have demonstrated the hydroxyl groups in xylan molecules can be selectively oxidized to reactive aldehyde groups via inorganic oxides. Oxidized derivatives of xylan were successfully prepared when xylan extracted from sycamore wall shield was oxidized with sodium periodate, but there was a certain amount of xylan oligosaccharide during the reaction [23,24]. Similarly, $NaClO_2$ can be used as a reagent for the oxidative modification of xylan and it is a relatively selective to

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Towards high performance wood composites through interface customization with cellulose-based adhesive

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ABSTRACT

How to efficiently produce high-performance plywood is of particular concern, which is conducive to economic development. This paper presents a simple and scalable strategy for the preparation of high-performance plywood based on the chemical bonding theory. a novel cardanol-functionalized glutenin (MFGT) based on (3-glycidoxypropyl) trimethoxysilane (KH560) was established. Interestingly, the MFGT-enhanced dialdehyde cellulose-based adhesive (DAC/MFGT) was able to effectively establish chemically active adhesive interfaces. As-prepared plywood strength of MFGT/DAC/KH560 adhesive was 2.15 (1.76 MPa, which was nearly higher than 0.7 MPa (GB/T 9846-2015). The prepared plywood showed excellent wood-polymer interface adhesion, which revealed the basis that the wood itself would withstand. In addition, the DAC/MFGT adhesive exhibits moisture-responsive self-healing behavior in water environment and can easily support the weight of an adult weighing 65.7 kg. This research provides a novel approach for functionalized interface design of wood products, an effective means to prepare high-performance plywood.

1. Introduction

Wood adhesives are the soul of the engineered wood industry [1–3], but most of them are petroleum and non-renewable wood adhesives (89 % of the total adhesive volume), leading to increasing concerns about resource depletion and environmental impact. On the one hand, the development and use of bioresourced adhesives has become a hot research topic [4–7] as an alternative to petrochemical chemicals [8–11]; on the other hand, in order to expand the market for wood-based products, there is an urgent need to develop a simple and scalable strategy to improve the mechanical and water resistance properties of wood-based products [1–3].

Wood cell walls are high-precision three-composites consisting of cellulose, lignin and hemicellulose, exercise and large amounts of void volume [12]. In general, swelling and shrinking occur with changes in relative humidity due to adsorption and desorption of water by cell wall components [13]. As-prepared thermosetting adhesives in the microcracks and interstices easily accumulate heat to cracks and defects in the wood structure and may result in structural failure of the wood. A number of cyclic-to-methods have been developed to produce chemically modified polymer surfaces. These methods usually involve the introduction of chemically active groups followed by the formation of covalent cross-linking under specific conditions [14–17]. The main ones include plasma treatment [18], high voltage electric field treatment [19,20], oxidant treatment [21], and silane coupling agent treatment [22]. In recent years, silane coupling agents have been widely used due to their

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入学年月	2020年09月	毕业年月			学制	[illegible]	

类别	课程名称	学时数	学分	开课学期	成绩	缓考成绩	补考成绩	重修成绩
学位课	英语	64	3.0	1	91			
	中国特色社会主义理论与实践研究（专硕）	36	2.0	1	97			
	自然辩证法概论（专硕）	18	1.0	1	93			
	高等木材学	32	2.0	1	79			
	工程伦理	32	2.0	1	84			
	试验设计与数据处理	32	2.0	1	89			
	生物质资源化学与利用	32	2.0	1	91			
	生物质材料制造与装备	32	2.0	1	87			
	林业工程前沿	32	2.0	1	90			
	学位课小计		18.0					
非学位课	SCI论文写作	32	2.0	2	91			
	仪器分析	32	2.0	1	91			
	生物质高分子材料学	32	2.0	1	83			
	非学位课小计		6.0					
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2022年09月06日 2022年[illegible]月[illegible]日

研究生院（盖章）
2022年[illegible]月[illegible]日

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考试时间：--

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Article

Degradation of Mechanical Performance of Hoop Head Tenon-Mortise Joint of Tusi Manor with Decay Disease in Tibetan Areas in Yunnan

Zhengquan Nong [1], Hong Liu [1], Kun Wu [1], Man Yin [1], Zhe Yuan [1,*], Yanwei Su [1,*] and Mingli Qiang [2,*]

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Abstract: (1) The Hoop Head Tenon-mortise Joint (HHTMJ) in the Tusi Manor in Tibetan areas in Yunnan, China, has a serious decay phenomenon. To understand the effect of decay on the seismic performance of HHTMJ, (2) the five groups of HHTMJ and small-size *Pinus kesiya* var. *langbianensis* wood mechanical property testing specimens were placed in an artificially set decay environment and cultivated together with wood decay fungi for 0, 6, 12, 18, and 24 weeks, respectively. Low-cycle repeated loading tests were conducted to compare the failure mode, hysteresis curve, skeleton curve, and cumulative energy consumption of the HHTMJ under different decay cycles. (3) The results indicate that the failure mode of the HHTMJ is fractured at the tenon shoulder, and the deformation and failure of the tenon increase with the increase in decay. Compared with the non-decayed specimens, the ultimate bearing performance of the specimens after 6, 12, 18, and 24 weeks of decay decreased by 8.83%, 16.57%, 19.89%, and 30.22%, respectively. The cumulative energy consumption decreased by 21.4%, 27.4%, 33.2%, and 41.3%, respectively. (4) Decay primarily occurs on the exterior of the tenon, with minimal decay on the mortise. The degradation of seismic performance in HHTMJ is relatively close to the degradation observed in small-size wood specimens during mechanical property testing.

Keywords: Tusi Manor; heritage timber building; Hoop Head Tenon-mortise joint; low-cycle repeated loading; degradation of mechanical properties

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1. Introduction

Wooden frame ancient buildings constitute the primary components of traditional Chinese architecture [1]. In the Tibetan areas of Yunnan, the internal wooden frames of Tusi Manor buildings play a crucial load-bearing role, while the external walls consist of rammed earth, as depicted in Figure 1. The Tibetan areas in Yunnan encompass a

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类别	课程名称	学时数	学分	修读学期	成绩	[illegible]
学位课	英语听力1	36	0.5	1	71.00	71.00
	英语精读1	72	1.5	1	68.00	68.00
	自然辩证法概论	18	1.0	1	86.00	86.00
	木结构建筑文化	48	3.0	2	90.00	90.00
	木结构建筑[illegible]	48	3.0	2	93.00	93.00
	木结构建筑材料学	48	3.0	2	91.00	91.00
	英语听力2	36	0.5	2	73.00	73.00
	英语精读2	72	1.5	2	68.00	68.00
	新时代中国特色社会主义理论与实践	36	2.0	2	89.00	89.00
	专业英语	32	2.0	2	87.00	87.00
	学位课小计		18.0			
非学位课	试验设计与数据处理	32	2.0	1	91.00	91.00
	弹性力学及有限元	48	3.0	1	80.00	80.00
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	SCI 论文写作	32	2.0	2	88.00	88.00
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Laminated composite fabricated using high-performance polyamine thermoset: Ultra heat resistance and excellent mechanical property

Yilin Shen, Shengjiao Wang, Guanben Du, Tao Qin, Shuyang Jiang, Shuoping Liu, Zhigang Duan, Hui Niu, Taohong Li

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ABSTRACT

Developing polymer composites that can work in harsh environments are important for advancing materials industry. However, the composites generally based on epoxy or phenolic resins that can endure both extremely high and low temperature are still rather limited. In this work, melamine-formaldehyde ([illegible]) thermoset which is structurally different from conventional matrices was used as matrix resin for woven glass fiber reinforced [illegible] laminated composite. Owing to the excellent thermostability (T_g = [illegible] °C) and interfacial compatibility of the [illegible] matrix, the fabricated composites exhibited exceptional resistance to extreme temperatures and mechanical performances, which are superior to that of the representative commercial epoxy-based composites. Particularly, the heat deflection temperature (HDT) of [illegible] was above 300 °C which is much higher than that of the representative high-performance commercial composites ([illegible] °C). Moreover, [illegible] composite exhibited excellent nonignitability even at [illegible] °C while severe carbonization and delamination occurred in all the selected commercial products. Further, the [illegible] laminate exhibited flexural strength of [illegible] MPa at room temperature, higher than that of the commercial products by [illegible] MPa. Remarkably, the flexural strength increased to [illegible] MPa at 77 K without declining of toughness, suggesting the excellent resistance to cryogenic temperatures. In summary, the results of the study disclosed the suitability of [illegible] resin as a new matrix of glass fiber reinforced engineering materials.

1. Introduction

Fiber-reinforced polymer (FRP) composites have been important engineering materials widely used in both civil and high-tech fields, due to their characteristics of high mechanical strength, low density, good corrosion and fatigue resistance, low coefficient of thermal expansion and controllable electrical conductivity [1,2]. With these advantages, FRP composites have been increasingly replacing conventional materials like metals, wood and concrete in many applications such as infrastructure, energy, chemical engineering, automobile, aircraft, aerospace, marine, superconductivity, electronics and defense, etc. [3–5].

In composites, the reinforcements act as load-bearing element while the matrix is responsible for load transferring and protecting the structure against severe environmental conditions like high or cryogenic temperatures, corrosion and moisture [6]. Currently, the fiber reinforcements mainly include glass fiber, carbon fiber and aramid fiber. Due to cost-effective advantage, glass fiber reinforced polymer (GFRP) composites are currently most used, like chemical storage tanks, transportation pipes, automobile, wind turbine blades, printed circuit board substrate, etc [7]. The polymer matrix can be chosen from different thermosetting or thermoplastic resins like epoxy (EP), phenolic-formaldehyde (PF), polyester, unsaturated polyester (UP), nylon, polycarbonate (PC), etc. Thanks to the advantages like ease of

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Research Article

High-Performance Basalt-Fiber-Reinforced Laminated Composites: Free of Fiber Surface Modification and Sizing Agent

Yilin Shen, Zhigang Duan, Shouqing Liu,* Shuyang Jiang, Tao Qin, and Taohong Li*

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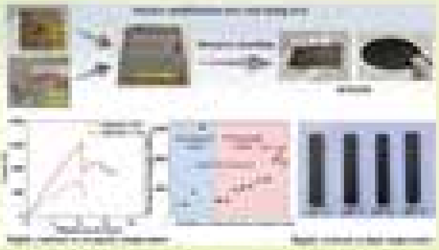
ABSTRACT: Thanks to the advantages of synthesis-free, excellent mechanical properties and heat resistance, basalt fibers (BFs) have been viewed as a new generation of reinforcement, which is a promising substitute for synthetic glass fibers. However, achieving satisfied comprehensive performances for BF-reinforced composites is still a great challenge because of the poor interfacial compatibility of BF toward conventional matrix resins. In this study, a melamine−hexamethylenediamine (MH) thermoset was used for the first time as the matrix of BF-reinforced laminated composites. With no surface modifications performed and no sizing agent used, the BF-reinforced MH composites (BFRMH) exhibited excellent comprehensive performances. Specifically, the BFRMH composites have heat deflection temperature above 300 °C, flexural strength up to 730 MPa, and interlaminar shear strength above 60 MPa. Particularly, the BFRMH composites are highly resistant to extreme temperatures as enhanced mechanical strength and toughness were observed at 77 K, and 78% flexural strength retained even after treated at 798 K. These performances are far superior to that of reported BF-reinforced composites and of the glass-fiber-reinforced composites. In addition, the excellent chemical resistance, insulating property, conductivity, as well as flame retardancy (UL94-V0) suggest that the BFRMH composites are potential materials for electrical and electronic applications. The results of this work revealed the great potential and suitability of the MH resin matrix for fabricating BF-reinforced composites, due to its excellent interfacial compatibility.



KEYWORDS: basalt fiber, reinforced composites, melamine−hexamethylenediamine resin, mechanical strength

■ INTRODUCTION

Owning to the excellent mechanical properties and high resistance to chemical corrosion, fiber-reinforced polymer composites have been widely used in many industrial areas like civil constructions, marine, aerospace, machines, automobile, and electronic and electrical engineering.[1] In the past decades, typical synthetic fibers, mainly including glass fibers, carbon fibers, and aramid fibers, are the predominant reinforcements in the market, due to their advantages including high specific strength, strong weatherability, and high-temperature resistance.[2−4] However, manufacture of the synthetic fibers heavily relies on the fossil resource, and the production of fibers causes high energy-consumption and environmental pollution.[5,6] Seeking sustainable fibers as partial substitutes is promising to reduce the negative effects caused by the production of synthetic fibers. The potential applications of some natural fibers like spider silk, hemp fiber, and bamboo fiber have been intensively studied.[7−9] But some disadvantages of these fibers like difficulty in obtaining and processing, as well as poor heat resistance, largely limit their application as engineering materials.[10−14]

Mineral fibers from basalt which is continuously extruded from melted volcanic basalt stones containing 45−52% SiO_2 have been gaining increasing attention in the recent decade, due to their advantages of synthesis-free, low cost, high modulus, excellent heat resistance, good sound insulating property, and low water absorption.[15−17] In contrast to conventional synthetic fibers, production of the basalt fiber (BF) consumes less energy and avoids use of toxic chemicals. As a newly emerging star in the family of fabric reinforcements, the potential of BFs as an alternative to glass fibers is a relatively new topic. Despite the attractive advantages of BF, the reported studies have shown that BF-reinforced polymer (BFRP) composites did not exhibit satisfied comprehensive performances if fiber surface modification was not conducted.

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Novel melamine-based engineering thermosets: Facile synthesis, extraordinary thermostability, high strength and toughness

Shengtao Wang [a,b,1], Yilin Shen [a,1], Guanben Du [a,b,c,*], Shiyang Jiang [a], Shouqing Liu [b,*], Hui Nie [a], Le Li [a], Tao Qin [a], Zhigang Dean [a], Taolong Li [a,b,c,*]

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ABSTRACT

Extreme temperature resistance, high strength and toughness are desired properties for polymeric engineering materials used in diverse fields like aerospace, military and superconductivity industries. In this study, two facile, one-step monomeric thermosetting resins were synthesized by hydrazine condensation of melamine (M) and 1,4-bis(aminophenoxy)benzene (N), endowing the MN resin with extraordinary thermostability and peculiar mechanical properties. Particularly, the decomposition temperature ($T_{5\%}$) of MN resin was measured to be above 440 °C, superior to most resinous materials. Different from typical thermosets which are strong but brittle, the MN resin appeared to be strong and tough. Obvious yield was observed in compression strength tests and the yield strengths above 240 MPa were achieved at room temperature and cryogenic temperatures (−196 °C) with high strains as 25 ~ 29 %. Further, tensile strength around 70 MPa was obtained with high toughness (>2 %-m) levels. The excellent resin network including extra C–C in the thiol-ene structure, namely MPN, exhibited superior mechanical properties were achieved. As structural adhesives, the two resins exhibited excellent bonding performance in different substrates at room temperature and extreme temperatures, which is comparable or superior to polyurethane (PU) and epoxy resins.

1. Introduction

Developing high-performance engineering polymers with excellent resistance to extreme temperature, high strength and toughness have been hot and challenging topics as these polymers have important applications in many civil and high-tech fields including infrastructure, automobile industries, aerospace (aircraft and space vehicle construction), military, superconductivity, electronics, etc. [1–4]. Specifically, when they used as structural adhesives, in comparison to conventional joining technologies, adhesive bonding allows joining of different materials and produces structures with improved fatigue performance. The resins with excellent adhesion property and biomedical compatibility are also made into reinforced composites that can provide outstanding mechanical performance and reduced weight [5,6]. In aerospace applications, it's a tendency to replace metal structural materials such as steel, aluminium and titanium by these composites. Examples are that the carbon fiber reinforced resin matrix composites can be candidate materials for lightweight cryogenic fuel tanks of liquid rockets [7].

The materials working at extreme temperatures exist here across cryogenic environments (liquid oxygen: -183 °C, liquid nitrogen: −196 °C, or liquid hydrogen: -253 °C) or higher temperature above 150 °C for both short-term and long-term applications. Among the commercial polymeric materials, polyurethane (PU)- based materials possess best cryogenic properties owning to their high chain flexibility [8]. According to the reported results, some of polyurethane-type adhesives can provide tensile shear strength of 20 ~ 40 MPa at −196 °C in binding steel or aluminium materials. However, they exhibited much lower adhesive strength at room temperature and poor strength at temperature above 149 °C [9,10]. After modification by other polymers, the high temperature performance can be improved, but application at temperatures higher than 200 °C is still a challenge [11].

Epoxy (EP)-type resins are currently most used polymeric materials in fields of coatings, adhesives and composites, owning to their advantages of beneficial compatibility, adhesive properties and good

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总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
445	155	165	125

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准考证号：---
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成绩报告单编号：202153006000964

教育部考试中心
证书专用章

JOC The Journal of Organic Chemistry

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Alkynylation of Isatin Derivatives Catalyzed by a Silver–Chiral Quaternary Ammonium Salt Derived from Quinine

Xinhao Sun, Chaoyi Xiong, Fanmu Zhou, Kun Liang,* Chunhua Wu, Xiaoping Rao, and Qian Chen*

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ABSTRACT: Asymmetric addition of terminal alkynes catalyzed by a transition metal to isatins obviously is an efficient and economic method for the synthesis of 3-alkynyl-3-hydroxy-2-oxindoles. The new dimeric chiral quaternary ammonium derived from a natural chiral alkaloid, quinine, can be used as cationic inducers of the enantioselectivity for the Ag(I)-catalyzed alkynylation of isatin derivatives under mild conditions. The desired chiral 3-alkynyl-3-hydroxy-2-oxindoles can be obtained in good to high yields with high to excellent enantioselectivities (≤99% ee). A variety of aryl-substituted terminal alkynes and substituted isatins are tolerated in this reaction.

The formation of C–C bonds catalyzed by transition metals in the presence of chiral ligands has been proven to be one of the most efficient approaches for the asymmetric synthesis of chiral compounds. Typically, the active cationic or neutral metal species was formed in situ by the coordination of a metal with a neutral ligand. In recent years, transition-metal-catalyzed asymmetric synthesis was achieved by using a weak coordination chiral anionic ligand, namely, asymmetric counteranion-directed catalysis, or chiral ion-pairing catalysis.[1–3] More recently, a new asymmetric inductive strategy was developed for transition-metal-catalyzed asymmetric C–C bond formation, which was directed by chiral cations: quaternary ammonium, imidazolium, bisguanidinium, etc.[4] Although there have been few successful examples, this approach will become a new topic in asymmetric catalysis.

Chiral 3-substituted 3-hydroxy-2-oxindoles and their derivatives, as an important class of nitrogen-containing compounds, are broadly found in biologically active compounds such as convolutamydine D, YK-4-279, and chelespiramidine (Figure 1).[5] In particular, 3-alkynyl-3-hydroxyoxindoles and their derivatives have attracted a great deal of interest in organic and medicinal chemistry because they are regarded as analogues of efavirenz and can be used as important intermediates for further transformation.[6] Because of the biological activity and potential utility of the 3-alkynyl-3-hydroxyoxindoles mentioned above, access to the 3-alkynyl-3-hydroxyoxindoles and their derivatives has been the object of great efforts in organic community.

Asymmetric addition of a transition-metal alkynilide, formed in situ from a terminal alkyne and a catalytic amount of a transition metal, to isatins obviously is an efficient and economic method for the synthesis of 3-alkynyl-3-hydroxy-2-oxindoles.[7] Among the transition-metal catalytic asymmetric addition of terminal alkyne to isatins, Cu(I) complexes with several chiral nitrogen- and/or phosphorus-containing ligands were successfully developed.[8] Zn(II) complexes generated from $Zn(OTf)_2$ and chiral hydroxyl oxazolines or bis(sulfonamide)-diamine ligands were also efficient catalytic systems for the production of 3-alkynyl-3-hydroxy-2-oxin-

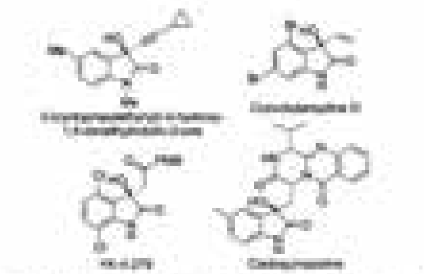

Figure 1. Representative bioactive compounds bearing chiral 3-substituted 3-hydroxy-2-oxindoles.

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入学年月	2020-09-23		毕业年月		2023-06-13	学制	3

类别	课程名称	学时数	学分	开课学期	成绩	备注
学位课	试验设计与数据处理		2.0	1	85.00	
	林业工程进展		2.0	1	91.00	
	高等有机化学		3.0	1	86.00	
	自然辩证法概论		1.0	1	80.00	
	专业英语		2.0	1	76.00	
	英语听力		0.5	1	72.00	
	英语精读		1.0	1	77.00	
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	学位英语		0.5	2	63.00	
	中国特色社会主义理论与实践研究		2.0	2	75.00	
	英语精读		1.0	2	68.00	
	英语写作		0.5	2	75.00	
	英语听力		0.5	2	65.00	
	学位课小计		15.0			
非学位课	生物质资源化学与利用		2.0	1	88.00	
	催化剂工程		2.0	1	80.00	
	化工分离技术		2.0	1	87.00	
	现代分析测试原理与技术		2.0	1	85.00	
	非学位课小计		8.0			

学位（毕业）论文题目	[illegible]		
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备注			

成绩专用章

全国大学英语四级考试(CET4)成绩报告单

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准考证号: 131270203103927

总　　分: 437

听　　力: 152

阅　　读: 153

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吐温-60对钢在$Cl_2CHCOOH$溶液中的缓蚀性能

[illegible]

摘要：[illegible]

关键词：[illegible]

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西南林业大学研究生成绩单

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
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全国大学英语四级考试(CET4)成绩详情

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总　　分：430

听　　力：134

阅　　读：171

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Comparison of different drying techniques for Zanthoxylum bungeanum leaves: Changes in color, microstructure, antioxidant capacities, and volatile components

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ARTICLE INFO

Keywords:
Zanthoxylum bungeanum leaves
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ABSTRACT

Herein, the effects of different drying methods, namely, hot-air drying (HD), vacuum freeze drying (VFD), vacuum drying (VD), hot-air drying (AD), and microwave drying (MD) on the qualities of Zanthoxylum bungeanum leaves were investigated. The L*-a*-b* of Z. bungeanum leaves changed their original color to a greater extent. The microstructural cross-sections were significantly affected by the different drying methods. Interestingly, in addition, MD and VD had better Rehydration and Shrinkage ratios than the other drying methods. Moreover, the contents of total phenolic and flavonoid compounds in fresh leaves were 61.47 mg GAE/g dw and 151.3 mg RE/g dw, respectively. Moreover, 107 volatile organic compounds (VOCs) were identified using headspace solid-phase microextraction gas chromatography-ion mobility spectrometry (HS-GC-IMS). Principal component analysis (PCA) and orthogonal partial least squares discriminant analysis (OPLS-DA) revealed that the volatile and aroma profiles of the VFD, HAD, and VD samples were similar and distinct. A comprehensive evaluation of the antioxidant value and aroma profile concluded that VFD is the most suitable drying method for Z. bungeanum leaves, owing to its high efficiency, low risk, and good product quality.

1. Introduction

Zanthoxylum bungeanum is a species of plant in the Rutaceae family. It is native to China, although it is widely distributed owing to its application in traditional medicine and foods (Zhang, Yu, Tian, & Wang, 2019). Z. bungeanum leaves, which are also made up-products of Z. bungeanum, have a distinctive aroma, leading to their use in food products (Zhang et al., 2021). Moreover, Z. bungeanum leaves are rich in proteins, fats, phenols, flavonoids, and other nutrients (Zhang et al., 2019) and exhibit various favorable effects, including antioxidant (Singh et al., 2019), antibacterial (Jiang et al., 2021), and anti-inflammatory effects (Zhang, Wang, Jiang, Yu, & Zhang, 2017). Currently, Z. bungeanum leaves are mainly used in the cities Bin, Sanmenxia, Hai, and Nanning, Inner Mongolia (Liao, Liang, & Tan, 2019; Ma et al., 2022; Wang, Ni, Li, & Wang, 2017). However, the unpleasantness of fresh leaves affects their applications values. To address this issue, the newest developments in drying technologies cannot only play, when the leaves can be dried more efficiently while also retaining a higher product quality (Ahmed, Hamdani Mercier, & Kaushik, 2019; Sun et al., 2022).

In recent years, different drying methods such as indoor natural drying (ND), vacuum freeze drying (VFD), vacuum drying (VD), hot-air drying (AD), and heat pump drying (HD) are commonly used for quality studies of plant samples. Nguyen et al. (2022) evaluated the effects of different drying methods like sun drying, AD, microwave drying, VD and VD on the quality of guava leaves and found that VD gave the best quality. Sun et al. (2022) found VD to be a promising industrial drying technology to alleviate problematic by comparing the effects of VD, AD and VD on the quality of rehydrated and instant. In addition, different drying methods such as AD, VD, microwave drying, sun drying, VD and VD were used to evaluate total phenolic content (TPC) and its antioxidant capacities of lemon pomelo leaves which revealed that VD was the most effective drying method (Chaiyaso, Techinbun, Wichienchot, &

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WANG Anna, PENG Xiaowei, KAN Huan, et al. Extraction of Flavonoids from *Docynia delavayi* and Their Antioxidant and Hypoglycemic Activities[J]. Science and Technology of Food Industry, 2023, 44(2): 232−240. (in Chinese with English abstract). doi: 10.13386/j.issn1002-0306.2022040129

· 工艺技术 ·

云南移依黄酮提取及其抗氧化、降血糖活性研究

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摘 要: [illegible] 50 ℃, [illegible] 3:2, [illegible] 50 min, [illegible] 30 mL/g, [illegible] 55%, pH4.5, [illegible] 13.30% [illegible] (13.01%) [illegible] DPPH [illegible] ABTS⁺ [illegible] IC_{50} [illegible] 0.04、0.29、0.70 mg/mL, [illegible] DPPH [illegible] ABTS⁺ [illegible] 93.00%、97.60%、44.56% [illegible] α-[illegible] IC_{50} [illegible] 0.86、0.37 mg/mL, [illegible] 12.0、3.0 mg/mL [illegible] 81.83%、82.72% [illegible]

关键词: 云南移依,黄酮,超声波辅助酶法,抗氧化,降血糖

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DOI: 10.13386/j.issn1002-0306.2022040129

本文网刊:

Extraction of Flavonoids from *Docynia delavayi* and Their Antioxidant and Hypoglycemic Activities

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Abstract: Taking *Docynia delavayi* as the raw material, the extraction of flavonoids by ultrasonic-assisted enzymatic method was optimized using response surface methodology, and the in vitro antioxidant and hypoglycemic activities were determined. The results showed that the optimal process parameters were extraction temperature of 50 ℃, complex enzyme (pectinase and cellulase) of 3:2, extraction time of 50 min, liquid-material ratio of 30 mL/g, ethanol concentration of 55%, and pH of 4.5. Under these conditions, the yield of flavonoids from *D. delavayi* was as high as 13.30%, which was close to the predicted value (13.01%). *In vitro* antioxidant assays showed that flavonoids from *D. delavayi* scavenged DPPH, ABTS⁺ and hydroxyl radicals with IC_{50} values of 0.04, 0.29 and 0.70 mg/mL, and the scavenging rates of DPPH, ABTS⁺ and

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热带作物学报 2023, 44(4): 1253–1265
Chinese Journal of Tropical Crops

云南移依热风干操动力学模型及品质变化

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摘　要：为明确云南移依热风干操特点及适宜干燥温度，采用热风干燥法干燥移依，以云南移依为研究对象，探究不同温度（40、50、60、70 ℃）下云南移依的干燥特性及适宜干燥温度，探讨不同温度对移依干燥后品质的影响，为移依干燥加工提供理论依据。结果表明：云南移依干燥过程中水分比随时间的增加呈指数下降趋势，恒速干燥阶段不大明显，云南移依干燥过程主要为降速干燥阶段。干燥温度越高，干燥时间越短，干燥速率越大。采用 6 种薄层干燥模型对移依干燥过程进行拟合，Page 模型拟合效果最好，决定系数（R^2）为 0.9981 以上，水分扩散系数（D_{eff}）为 1.9×10^{-10}～3.9×10^{-10} m^2/s，活化能（E_a）为 43.64 kJ/mol，通过菲克第二定律及 Page 模型拟合得知，温度越高，干燥速率越大，水分扩散系数越大，干燥时间越短。$40\sim70$ ℃干燥过程中，移依干燥后的复水比、总酚含量、总黄酮含量、多糖含量及抗氧化能力均呈现先增加后减小的变化趋势，其中 60 ℃干燥后移依的复水比、总酚含量、总黄酮含量及抗氧化能力均最高，分别为 3.41、1.64%、1.21%、1.14%、0.64 mmol/g，60 ℃干燥后移依的多糖含量为 1.08%，仅次于 50 ℃干燥后移依的多糖含量（1.09%），60 ℃干燥后移依的色泽较为明亮，综合干燥时间、干燥速率、干燥后移依品质等因素，60 ℃为移依干燥的适宜温度。

关键词：云南移依；热风干燥；干燥动力学；品质特性

中图分类号：TS255.1　　**文献标识码：**A

Kinetic Model and Quality Change in Hot Air Drying of *Docynia delavayi* (Franch.) Schneid.

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Abstract: The drying characteristics of *Docynia delavayi* at different temperatures (40, 50, 60 and 70 ℃) were investigated and a kinetic model was established to clarify the hot air drying characteristics and appropriate drying temperature for *D. delavayi* and to achieve its quality control in the hot air drying process. The effect of different drying temperatures on the dried product quality in terms of color, rehydration ratio (RR), the contents of active ingredients (polyphenols, flavonoids, polysaccharides) and antioxidant capacities were evaluated. The moisture ratio curve of *D. delavayi* decayed exponentially during the drying process, and the drying rate curve was divided into three stages, acceleration, constant rate and decreasing rate. With the increase of drying temperature, the moisture diffusion of *D. delavayi* intensified, and the drying rate increased obviously, the effective diffusion coefficient of water (D_{eff}) and activation energy (E_a) was $9.81\sim10.7\times10^{-7}$ m^2/s and 27.64 kJ/mol, respectively. The data analysis revealed that the

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[illegible]
[illegible]

[illegible]

不同干燥方式对竹叶花椒叶品质的影响

[illegible]

[illegible]

摘要：【目的】[illegible]

关键词：[illegible]

Effects of Different Drying Methods on the Quality Characteristics of Dried *Zanthoxylum armatum* Leaves

[illegible]

Abstract: [illegible]

[illegible]

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姓名	[illegible]	性别	女	出生年月	1999-12-17	学号	[illegible]
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入学年月	2021-09-[illegible]	毕业年月		2024-07-01		学制	3

类别	课程名称	学时数	学分	修读学期	成绩	备注
学位课	食品质量与安全控制专题	32	2.0	1	91.00	
	食品加工与贮运专题	48	3.0	1	93.00	
	食品产业信息与风险安全	32	2.0	1	78.00	
	新时代中国特色社会主义理论与实践（专题）	36	2.0	1	87.00	
	自然辩证法概论（专题）	18	1.0	1	87.00	
	食品安全案例	32	2.0	1	86.00	
	现代农业创新与乡村振兴战略	32	2.0	1	80.00	
	英语	64	3.0	1	88.00	
	学位课合计		17.0			
非学位课	农林废弃物产品加工[illegible]	32	2.0	1	85.00	
	食品质量安全检测新技术进展	32	2.0	1	91.00	
	非学位课合计		4.0			

学位（毕业）论文题目	[illegible]		
论文答辩时间		论文答辩成绩	
备注			

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西南林业大学研究生院 成绩专用章

全国大学英语六级考试
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CET

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准考证号：330660772502526
考试时间：2017年12月

总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
447	141	194	112

口　试

准考证号：-
考试时间：-

等级	-

成绩报告单编号：172253000691243

教育部考试中心
证书专用章

聚乙烯亚胺改性尿素-乙二醛聚合物树脂性能研究

[illegible]

摘要： [illegible]

关键词： [illegible]

基金项目： [illegible]

号码： [illegible]

号码： [illegible]

分类号： [illegible]

冷榨核桃饼基木材胶黏剂的制备及性能研究

[illegible]

摘要： [illegible]

关键词： [illegible]

基金项目： [illegible]

号码： [illegible]

号码： [illegible]

分类号： [illegible]

核桃饼粕热解液与交化聚合物复合体系性能评价

摘要：

关键词：

基金资助：

专辑：

专题：

分类号：

氧化木薯淀粉改性MUF共缩聚树脂性能评价

摘要：

关键词：

基金资助：

专辑：

专题：

分类号：

Walnut Meal as Formaldehyde-free Adhesive for Plywood Panels

Hui Wang,[a] Feng Wang,[a] Guanben Du,[a] Liangjun Xiao,[b,*] and Xiaojian Zhou [a]

Walnut meal and polyethylenimine (PEI) were used as raw materials for producing an environmentally friendly adhesive to bond plywood, and the shear strength was investigated. The results showed that the walnut meal-based mixture adhesive can successfully be used for the production of plywood. However, the shear strength of plywood clearly changed with different raw materials ratios. Both the wet and hot water strength were improved with increasing polyethylenimine (PEI) content. This indicated that PEI had an important contribution to the water-resistance of the mixture system, and considering the cost of PEI, a walnut meal powder and PEI weight ratio of 70:30 was recommended. The effects of walnut protein solution thermal processing time and temperature were also studied. It was beneficial to enhance the wet and hot water shear strength of plywood to increase the thermal processing time and temperature. The investigation of curing characteristic of mixture system and monomer ingredient via differential scanning calorimetry (DSC) revealed that the curing peak temperature of the mixture system was similar to PEI, and that a chemical reaction should be made between them during the heating process. Lastly, the thermal characteristic of the mixture system was investigated via thermogravimetric (TG) analysis, where good thermal resistance was displayed.

Keywords: Walnut meal; Polyethylenimine; Bonding strength; Curing characteristics

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INTRODUCTION

Today, wood adhesives are mainly chemical synthetic polymers, especially formaldehyde-based resins such as urea-formaldehyde (UF), melamine-formaldehyde (MF), and melamine-urea-formaldehyde (MUF). Together they comprise up to 90% of the weight ratio in the wood industry. These types of resins have excellent characteristics, such as stronger bonding strength, relatively low cost, abundant raw material, *etc.*, but the formaldehyde release is their critical defect (Lee and Kim 2013; Yi *et al.* 2013). Meanwhile, the limits of formaldehyde-based adhesives are gradually focused with the growing societal demand for green and ecological processes. Therefore, to decrease the negative effects of formaldehyde on people's health and the environment, numerous methods have been reported in literature (Dunky 1998; Boran *et al.* 2011; Narayanan *et al.* 2014), such as lowering the resin final mole ratio, adding a formaldehyde scavenger, *etc.* Although great progress has been made, the potential harm of formaldehyde has not been completely eliminated.

Iranian Polymer Journal (2021) 30:[illegible]
https://doi.org/10.1007/s13726-021-[illegible]

ORIGINAL RESEARCH

Preparation and performance of a novel wood adhesive based on hyper-branched polyethyleneimine, urea and glyoxal

Hui Wang[1,2] · Feng Wang[3] · Guanben Du[1,2] · Qinchen Duan[1,2]

Received: 22 November 2020 / Accepted: 29 April 2021 / Published online: 30 May 2021

Abstract

To increase water resistance and bonding strength of urea-glyoxal (UG) resin as wood adhesive, using hyper-branched polyethyleneimine (HBPEI), urea (U) and glyoxal (G), a novel resin (HBPEIU-G) was designed and synthesized successfully. The HBPEI polymer was initially reacted with urea under heating condition without using extra catalyst, then glyoxal (40% aqueous solution) was directly added to it at molar ratio of 1:4:1. The structures of HBPEIU and performances of HBPEIU-G resin were distinguished when was applied as wood adhesive. The results of the prepared two-ply panels produced in laboratory showed that both dry and wet bonding strength of HBPEIU-G resin were far higher than that of the controlled UG resin. Especially, the wet bonding strength enhanced significantly from 0 MPa to 0.63 MPa. The results of electron spray ionization mass spectrometry (ESI-MS) and FTIR confirmed that the target products of HBPEIU polymer had been obtained and the chemical reaction between synthesized HBPEIU polymer and glyoxal have been occurred. In HBPEIU-G resin, the dominant oligomers were HBPEI branched polymer which offered enough network structure for excellent bonding strength. Meanwhile, the viscosity of HBPEIU-G resin was higher than that of the UG resin, and differential scanning calorimeter (DSC) analysis also indicated that the curing peak temperature of HBPEIU-G resin was much lower than that of the UG resin.

Keywords Wood adhesive · Bonding strength · Water resistance · Curing characteristics · ESI-MS · FTIR

Introduction

Wood-based panels, such as particleboard, plywood and fiberboard can improve the overall utilization of wood. Meanwhile, the high demand of wood adhesive is increasing yearly, especially the formaldehyde-based polymers owing to their excellent performance and relative lower cost [1–3]. But the harm of formaldehyde gas as a carcinogenic agent to human health and environment has involved people's much attention gradually [4–6]. Thus, to develop a green and non-toxic wood adhesive is very crucial to wood industry. Up to now, considerable research works have been conducted and much progresses have been achieved. In practice, the potential threat of formaldehyde to the environment and human health cannot be avoided completely as long as formaldehyde is a main reactant in the manufacturing of formaldehyde-based resins due to a lot of existed reversible reactions.

One of the best effective methods to reduce formaldehyde emission and obtain a nontoxic resin is to find an alternative aldehyde for formaldehyde. Among the various aldehydes possible, glyoxal was considered as an effective substitute due to the advantages of mature production technology, being nontoxic, low cost, nonvolatile and easy biodegradable [7–9]. And glyoxal is already used as a substitute of formaldehyde in wood adhesive applications; however, the mechanical strength was still significantly lower than that of the commercial UF and PF resins, especially the wet strength and water resistance ability, due to the lower chemical reactivity of glyoxal than formaldehyde and lack of sufficient cross-linking networks structure. Thus, to enhance the mechanical strength of glyoxal-based resins,

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Iranian Polymer Journal
https://doi.org/10.1007/s13726-019-00788-9

ORIGINAL RESEARCH

Enhanced performance of urea–glyoxal polymer with oxidized cassava starch as wood adhesive

Hui Wang[1,2] · Feng Wang[1,2] · Guanben Du[1,2]

Received: 30 June 2019 / Accepted: 1 October 2019

Abstract
To eliminate the hazard of formaldehyde from wood-based products to human and environment, formaldehyde was replaced by glyoxal to produce wood adhesive. Urea–glyoxal (UG) resin was environmental friendly, while its bonding strength was very poor, especially its water resistance. The object of this work was to improve the mechanical properties of UG resin by oxidized cassava starch additives. Hence, the urea–glyoxal (UG) resin was synthesized and the oxidized cassava starch was added through mechanical mixing. The bonding strength, structure distributions, and the morphology features of the cured UG resin system were investigated by producing a three-layer plywood, FTIR, and SEM analyses. The results of dry and wet shear strength of plywood indicated that there was a positive effect of oxidized cassava starch on bonding strength of a three-layer plywood, and when the oxidized cassava starch content was increased to 4%, the dry strength could reach 1.21 MPa, and the wet strength was 0.72 MPa. The FTIR results showed that chemical reaction between UG resin and oxidized cassava starch was beneficial to the branched structure formation and higher cohesion strength of UG resin. Meanwhile, the tightness structure of enhanced UG resin system was observed by SEM analysis as well. These improved properties were contributed to water resistance improvement of UG resin.

Keywords Oxidized cassava starch · Urea–glyoxal polymer · Wood adhesive · Bonding strength · Structures

Introduction

Urea–formaldehyde (UF) resins are widely used for production of interior wood-based panels, such as particle board, medium density fiber board, plywood and so on. As an important chemical synthetic polymer, UF resins have some outstanding advantages including high reactivity, fast cure, low price, which has been one of the most important adhesives in wood industry [1, 2]. UF resins are mainly produced from the reaction of two monomers: urea and formaldehyde, usually, some residual free formaldehyde in UF resin and hydroxymethyl reversible reaction of cured resin result in formaldehyde emission from wood-based products, which causes indoor air pollution and health problems [3–5]. Formaldehyde has been categorized as a carcinogenic and toxic material, with acute oral toxicity (LD50) of 800 mg/kg (rat) based on the material safety data sheet (MSDS) of science lab [6, 7]. To reduce the hazard of formaldehyde, hence, it was necessary to seek an alternative aldehydes to formaldehyde. Glyoxal was considered as an effective substitute due to the advantages of manufacturing technology, being non-toxic, low cost, non-volatile and easy biodegradable among the various aldehydes [8].

In recent years, many research works on urea–glyoxal resins for wood adhesives have been reported. Although the UG resins are eco-friendly, the mechanical strength of urea–glyoxal (UG) resins are weaker compared to those based on formaldehyde resins, the reason is that the chemical reactivity of glyoxal is lower than that of formaldehyde, which cannot many linear polymer chains between urea and glyoxal during processing, the network structure is difficult to form, and the water resistance is poor as well. Thus, to improve the mechanical properties of UG resins used as wood adhesives, several methods have been proposed. The most acceptable

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Published online: 05 November 2019

证书号第3858036号

发明专利证书

发明名称：一种复合板用核桃饼粕蛋白胶黏剂及其制备方法

发明人：王辉；王风；杜官本；周晓剑；雷洪

专利号：ZL 2018 1 1092713.3

专利申请日：2018年09月19日

专利权人：西南林业大学

地址：650224 云南省昆明市盘龙区白龙寺300号西南林业大学

授权公告日：2020年06月26日　　授权公告号：CN 109370512 B

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局长
申长雨

2020年06月26日

第1页（共2页）

其他事项参见续页

氧化木薯淀粉改性MUF树脂的性能与固化特征

王伟 王秀丽 王丽 杜官本

西南林业大学土木工程与力学学院 云南省高分子材料

摘要：通过对三聚氰胺-尿素-甲醛树脂(MUF)合成过程的不同阶段添加氧化木薯淀粉(OMS)制备得到了不同改性MUF树脂。研究了添加时间、OMS用量对MUF树脂游离甲醛含量和固体含量的影响。采用DSC、FT-IR对OMS改性MUF树脂的固化过程进行了分析。结果表明：OMS的加入降低了MUF树脂的游离甲醛含量，提高了固体含量。当OMS用量为15%时，改性MUF树脂的游离甲醛含量为0.12%，固体含量为65.3%，满足E1级人造板用胶要求。DSC分析表明，OMS改性MUF树脂的固化峰温度比未改性MUF树脂降低了约8℃，固化活化能降低了约12kJ/mol。FT-IR分析表明，OMS的羟基参与了MUF树脂的固化反应，形成了更多的醚键结构。

关键词：MUF树脂；氧化木薯淀粉；改性；固化特征

基金项目：云南省科技厅重点研发计划项目(2018BB001)；西南林业大学人才引进项目(111806)

作者：王伟(1978-)，男，副教授，博士，研究方向为木质复合材料胶黏剂。

通讯作者：王丽，女，教授，博士生导师，研究方向为生物质基胶黏剂。

分类号：TQ433.4

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学科专业	木材科学与技术		培养层次		硕士		
入学年月	2017年9月	毕业年月			学制	3.0	

类别	课程名称	学时数	学分	开课学期	成绩	缓考成绩	补考成绩	重修成绩
学位课程	英语精读	77	3	1	84			
	英语精读	77		2	78			
	英语听力	36	1	1	84			
	英语听力	36		2	84			
	英语口语	36	0	1	77			
	英语写作	36	0	2	83			
	学位英语	0	0	2	72			
	中国特色社会主义理论与实践研究	32	2	2	83			
	自然辩证法概论	32	1	1	79			
	专业英语	32	2	1	86			
	生物质材料科学	32	2	1	76			
	胶黏剂与人造板工艺学	32	2	1	88			
	木材化学与保护	32	2	1	75			
	试验设计与数据处理	48	3	1	94			
	学位课小计		18					
非学位课程	木材物理	32	2	2	91			
	材料研究方法	32	2	2	90			
	木材功能性改良	32	2	2	87			
	非学位课小计		6					
学位（毕业）论文题目								
论文答辩时间		论文答辩成绩						
备注								

审核人（签章）
2020年05月13日

学院（部）（盖章）
2020年05月13日

研究生部（盖章）
2020年05月13日

成 绩 证 明

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于 2014 年 6 月参加 全国大学英语四级

考试。成绩 信息如下：

总分：474

听力 (35%)	阅读 (35%)	写作和翻译 (30%)
160	168	146

学校名称：西南林业大学

准考证号：530060141101727

成绩单编号：1411530060000156

2024 年 03 月 21 日

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基于IAWA的3种简易木材识别方法探究

[illegible]
（西南林业大学材料科学与工程学院，云南 昆明 650224）

摘要：[illegible]

关键词：[illegible]

中图分类号：S781　　**文献标志码**：A　　**文章编号**：2095-1914(2019)06-0167-06

Research on 3 Simple Wood Identification Methods Based on IAWA

Wang Xian, Shen Huajie, Yu Qinglin, Qiu Jian
(College of Material Science and Engineering, Southwest Forestry University, Kunming Yunnan 650224, China)

Abstract: The IAWA (International Association of Wood Anatomists) lists 3 method for rapid identification of hardwood species, including foaming test, chrome azurol-s test, and burning ashes test. The purpose of this study is to report the results obtained from the three test methods of 56 materials. The results showed that 9 out of 56 broad-leaf materials had foaming reaction, 15 species were weakly positive, and 32 species were negative. Only 6 of the 56 species of materials showed a positive chrome-blue color reaction. In burning ashes test, there are 10 species of bright white ashes, 14 species burning a tan ashes, 12 species burn into other color of ash, 19 species of coal ash, only 1 species is burning into charcoal. These 3 simple wood identification methods can effectively identify tree species, and provide a basis for identifying imported logs and similar tree species in the field.

Key words: hardwood species; foaming test; chrome azurol-s test; burning ash test; wood identification

随着中国经济的发展，我国已成为世界第1大进口国和第2大木材消耗国[1]，而木材识别的方法发展至今已有很多种。早期的树种识别主要靠人的经验和知识，根据宏观和微观特征并结合物理和化学方法进行辅助识别[2-3]。随着科技的不断发展与进步，木材识别技术有了新的突破，出现了DNA标记技术并在鉴定中已经得到了应用[4-6]，红外光谱分析技术[7-12]、GC-MS分析技

[illegible]

证书

编号：2023 年 0720 号

根据《云南省科技特派员认定管理办法》（云科规〔2018〕2号），认定

西南林业大学

王龙 同志为云南省科技特派员，有效期三年（2023年1月—2025年12月）。

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获奖等级：一等奖

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证书编号：YN－2022040047

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获 奖 者：邱　坚　高景然　李　智
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秦　磊　甘菖涛　王　宪
万　辉

获奖等级：二等奖

云南省教育厅
二〇二三年二月

西南林业大学研究生成绩单

姓名	[illegible]	性别	男	出生年月	[illegible]	学号	[illegible]
学科专业	木材科学与技术([illegible])			指导教师	[illegible]		
入学年月	[illegible]	毕业年月		[illegible]		学制	3

类别	课程名称	学时数	学分	开课学期	成绩	补考成绩	[illegible]	[illegible]
学位课	专业英语		2.0	1	94.00			
	木材化学与保护		2.0	1	80.00			
	英语阅读		1.5	1	68.00			
	生物质材料科学		2.0	1	90.00			
	胶黏剂与人造板工艺学		2.0	1	90.00			
	英语听力		0.5	1	75.00			
	自然辩证法概论		1.0	1	89.00			
	英语听力		0.5	2	75.00			
	英语口语		0.5	1	81.00			
	试验设计与数据处理		2.0	1	94.00			
	学位英语		0.5	2	71.00			
	英语写作		0.5	2	93.00			
	英语阅读		1.5	2	80.00			
	中国特色社会主义理论与实践研究		2.0	2	86.00			
	学位课小计		[illegible]					
非学位课	材料研究方法		2.0	2	89.00			
	木材物理		2.0	2	95.00			
	木材功能性改良		2.0	2	87.00			
	非学位课小计		6.0					

学位（毕业）论文题目			
论文答辩时间		论文答辩成绩	
备注			

西南林业大学研究生处 成绩专用章

大学英语四级考试(网考)
成绩报告单

CET

姓　　名：王自梁

学　　校：延边大学

院（系）：药学院

准考证号：F220471120401144

身份证号：[redacted]

考试时间：2012 年 11 月

总分：439

听力 (35%)	口语 (15%)	阅读 (35%)	写作 (15%)
145	50	175	69

成绩单编号：F120422047001179

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SHORT REPORT

A C G
publications

Rec. Nat. Prod. 18:2 (2024) 298-303

records of natural products

Phytosteroids from Roots of *Psammosilene tunicoides* W.C.Wu et C.Y.Wu

Ziliang Wang [1#], Hongrui Li [1#], Yuxiao Li [1,2], Kexin Nie [1], Xiuxia Yang [1], Xishan Bai [1], Yanhong Li [1*] and Xiangzhong Huang [1*]

[1]Key Laboratory of Chemistry in Ethnic Medicinal Resources, State Ethnic Affairs Commission and Ministry of Education, Yunnan Minzu University, Kunming, Yunnan 650504, P. R. China
[2]Yunnan Chinese Oriental Health Industry Innovation Research Institute, Tengchong, Yunnan 679100, P. R. China

(Received December 11, 2023; Revised February 03, 2024; Accepted February 05, 2024)

Abstract: To explore structurally and pharmacologically interesting secondary metabolites from *Psammosilene tunicoides*, a crude extract of this plant was investigated, leading to the isolation of a new phytoecdysteroid, [illegible] (1) and four known phytosteroid compounds, [illegible] (2), 22-deoxyecdysterone (3), β-sitosteryl [illegible] (4), and β-sitosterol (5). Their structures were identified based on a detailed analysis of NMR spectra and MS data. These compounds, except for 2, showed moderate NO inhibition activities on lipopolysaccharide (LPS)-induced release in RAW 264.7 cells.

Keywords: *Psammosilene tunicoides*; phytoecdysteroid; nitric oxide inhibition activity; RAW 264.7 cells.

1. Plant Source

The roots of *Psammosilene tunicoides* W. C. Wu et C. Y. Wu (Caryophyllaceae) were purchased from Kunming Luoshiwan medicinal material market of Yunnan Province in China and authenticated by A/Prof. Yang Xiong of the School of Ethnic Medicine, Yunnan Minzu University. A voucher specimen (JTS202201) was deposited in the herbarium of the above department.

2. Previous Studies

Psammosilene tunicoides is a unique monotype genus plant in southwestern China, and widely used to benefit the stomach and treat traumatic injuries and rheumatism [1]. *P. tunicoides* (so-called "Jin-Tie-Suo") is one of the important ingredients in the famous Chinese patent medicines "Yunnan Baiyao" and "Baibaodan Capsule" in Yunnan province. A growing number of the modern studies are focusing on

学习成绩记录表

学年	学期	课程名称	学时	学分	课程性质	成绩		任课教师
第一学年	第一学期	中国特色社会主义理论与实践研究	36	2	公共课	[illegible]		[illegible]
		自然辩证法概论	18	1	公共课	[illegible]		[illegible]
		临床药理学	48	3	专业基础课	[illegible]		[illegible]
		外国语（英语）1	72	2	公共课	[illegible]		[illegible]
		医学统计学	48	3	专业基础课	[illegible]		[illegible]
		[illegible]	32	2	专业课	[illegible]		[illegible]
		现代分离技术	32	2	专业课	[illegible]		[illegible]
		药学研究进展	48	3	专业基础课	[illegible]		[illegible]
		实验动物学	32	2	跨专业选修课	[illegible]		[illegible]
		天然药物化学专论	32	2	专业选修课	[illegible]		[illegible]
		医学科研方法	16	1	专业选修课	[illegible]		[illegible]
	第二学期	[illegible]	32	2	专业选修课	[illegible]		[illegible]
		分子生物学	48	3	专业基础课	[illegible]		[illegible]
		外国语（英语）2	72	2	公共课	[illegible]		[illegible]
		新药设计与开发	32	2	专业课	[illegible]		[illegible]
		天然产物结构分析	32	2	专业课	[illegible]		[illegible]
		[illegible]	32	2	专业选修课	[illegible]		[illegible]
		天然产物化学	32	2	专业选修课	[illegible]		[illegible]
		天然产物现代分离技术	32	2	专业选修课	[illegible]		[illegible]
第二学年	第三学期							
	第四学期							
第三学年	第五学期							

学位课主题目：[illegible]

[illegible]

填表人：[illegible]　　负责人：　　（公章）

注：[illegible]

3

全国大学英语四级考试(CET4)成绩报告单

姓　　名：吴博宇

证件号码：[redacted]

学　　校：西南林业大学

笔试成绩

准考证号：530060191102511

总　　分：430

听　　力：151

阅　　读：140

写作和翻译：139

考试时间：2019年 6 月

口试成绩

准考证号：--

等　　级：--

考试时间：--

成绩报告单编号：191153006002633

JSFU-NS 西南林业大学学报（自然科学）
Journal of Southwest Forestry University (Natural Sciences)
1981 年创刊

稿件录用通知

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您的文稿《一株产香云芝菌丝体的培养条件优化及其挥发性成分分析》（稿件编号：202311019），经本刊编委会审核，决定采用，拟在2024年第6期发表。如遇特殊情况，刊期顺延。

特此通知！

全体作者：吴倩宇，曹斌，严文行，葛卫源，王玮，杨晓琴，严冬，赵平

《西南林业大学学报》
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	学分累计		[illegible]				
非学位课	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	学分累计		[illegible]				
学位（毕业）论文题目	[illegible]						
论文答辩时间			论文答辩成绩				
备注							

全国大学英语四级考试
成绩报告单

CET

姓　　名：
学　　校：西南林业大学
院　　系：化学工程学院
准考证号：[redacted]

笔试				
总分				
448	143	170	127	

口试	
成绩	--

考试时间：--

成绩报告单编号：

全国大学英语四级考试
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2. CET考试考试时间为每年6月和12月，CET-口语考试时间为每年5月和11月。

3. 考生可登录中国教育考试网（www.neea.edu.cn）查询。下载电子成绩报告单的打印件和纸质成绩证明。电子成绩报告单和纸质成绩证书与成绩通知单具有同等效力。

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良好	能用较为标准的发音和语调表达所要传达的信息，基础语法基本正确，偶有单词和用法错误，但不影响交际。
合格	能用简单的单词和语句表达所要传达的信息，语音和语调基本正确，偶有单词和用法错误。

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Triazine-based sulphur-containing polymers for Hg^{2+} adsorption: Efficiency and mechanism

Chenji Xiong [a], Hao Wang [a], Zhenghao Zhang [a], Kun Liang [a,*], Chenhua Wu [a], Wei Wu [b,**], Xiaoping Rao [c], Qian Chen [b,***]

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ARTICLE INFO

Keywords:
Triazine-based sulfur-containing polymers
Adsorption
Hg^{2+} adsorption
Microporosity
Density functional theory

ABSTRACT

Recently, the research on the materials for removal of heavy metals is ongoing rapidly. Here we have studied four triazine-based sulfur-containing polymers with different linkers, namely PDTT, PDTD, BDTT, and BDTD. They have been successfully synthesized by the nucleophilic substitution reaction of cyanuric chloride with propane-1,3-dithiol (PDTT and PDTD) and toluene-1,3-dithiol (BDTT and BDTD) as different linkers. The physical and chemical properties of these polymers were characterized by scanning electron microscopy, energy dispersive spectroscopy, Fourier transform infrared spectroscopy, powder structure analysis and X-ray photoelectron spectroscopy. The optimized adsorption conditions was established by examining shaking, co-existing interspecies, contact time, concentrations, temperature and pH values. The adsorbing properties, which was mainly described by the pseudo-second-order kinetic and Langmuir isotherm models, indicated that the sorption of Hg^{2+} was the chemical adsorption. The maximum Hg^{2+} sorption capacities of PDTT, PDTD, BDTT and BDTD were 1440.97 mg g^{-1}, 1113.99 mg g^{-1}, 227.87 mg g^{-1} and 184.48 mg g^{-1}, respectively. Thermodynamically, the adsorption of Hg^{2+} by the adsorbents is a spontaneous process. Cyclic experiments demonstrated that all the adsorbents could be reused in five successive adsorption-action without significant losses in performance. Fast density functional theory calculations in combination with EXAFS experimental results revealed the coordination geometry of Hg and hence necessary adsorption mechanisms. These results suggested that triazine-based sulfur-containing polymers could be utilized as effective adsorbents for the removal of Hg^{2+} from polluted water.

1. Introduction

Toxic heavy metals might be released into the environment in a variety of ways, including automotive radiators, underground pipeline corrosion, smelting processes, fossil fuel combustion, urbanization and solid waste [1,2]. With rapid urbanization and industrialization, an increasing amount of heavy metals hazardous to the human health are being released into the environment, attracting increasing environmental concerns from the governments and the public [3,4]. High concentration heavy metals in wastewater produced by smelting, manufacturing, printing paper and electroplating have damaging effects on plants, animals and human beings [5–7]. Especially, Hg^{2+} is regarded as one of the most toxic and harmful heavy metal to water bodies because of its strong carcinogenicity and high toxicity [8,9]. Water-to-rivers, estuaries, lakes and oceans is one of the primary routes of human exposure to mercury [10], which is currently the third most toxic element to human skin health [11]. Bioaccumulation and bio-amplification of Hg^{2+} lead to adverse health effects after its entering the food chain [12,13]. Several high-profile instances of mass poisoning caused by Hg^{2+} and its products comprising between 1950 and 2000 killed millions of people and affected hundreds of thousands, prompting governments or organizations to conclude different treaties to deal with the issue [14]. Developing simple and effective methods for the removal of mercury from aqueous media is therefore of great importance.

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Novel triazine-based sulfur-containing polyamides: Preparation, adsorption efficiency and mechanism for mercury ions

Chenji Kong [a], Han Wang [a], Lihua Deng [a], Ran Liang [a,**], Chunhua Wu [a], Wei Wu [b,***], Qian Chen [b,c,*]

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ARTICLE INFO

Keywords:
Triazine
Sulfur-containing polyamide
Hg^{2+}
Adsorption mechanism

ABSTRACT

Two aminotriazine or phenolic 2,2'-(Propane-2,2-diyl-bis(4,1-phenylene))-bis(oxy)-bis(ethane-1-amine) diamines with thioether units dihydrated into polyamides, namely, **PAM1**, **PAM2** (triethylene, using phenolic 2,2'-(Ethane-1,2-diyl-bis(oxy))-diethanethiol), **EAM1** and **EAM2** were obtained. Their adsorption performances for Hg^{2+} in aqueous solutions were examined. The factors that affect the adsorption effect are investigated, such as the dose of adsorbent, the adsorption time, the temperature of the solution, the original concentration of the solution, the pH, co-existence and repeated applications. The pseudo-second-order kinetic model and Langmuir model are more suitable to describe the adsorptions of Hg^{2+}, and the saturated time of adsorption is 6 h. The maximum adsorption capacities were found to be 1,277 mg g^{-1} (**PAM1**), 1,499 mg g^{-1} (**PAM2**), 1,171 mg g^{-1} (**EAM1**) and 1,126 mg g^{-1} (**EAM2**), respectively. After 5 cycles of testing, there is no significant loss of adsorbed performance. Combining spectroscopic techniques, experimental results and DFT calculations, it is explained that S, N and, more interestingly, O on the polyamide are beneficial to the chemical adsorption process of Hg^{2+}. These results indicate that the polyamides can be used as efficient adsorbents for the adsorption of Hg^{2+} in wastewater.

1. Introduction

Mercury is highly toxic for humans as well as wildlife [1]. Once it enters the body, mercury can damage the reproductive system and cause a range of physical illnesses [2–4]. Mercury is emitted into the aquatic environments from a variety of activities, for example the manufacture of batteries and electronic equipment, smelting, burning fossil fuels and mining [5–7]. Subsequently, mercury is absorbed into the body through drinking water or through bioaccumulation in contaminated aquatic food chains [8,9]. In the natural environment, mercury mainly presents as an inorganic ion (Hg^{2+}) and in an organic form (CH_3Hg^+ or $CH_3OCH_2Hg^+$). In general, organic mercury is more toxic and more harmful to humans than inorganic mercury. Because mercury is more lipophilic and soluble in organic solvents, it can be found in natural aquatic environments and behavioral experiments as Hg^{2+} [10,11]. Thus, it is very significant to investigate the removal of Hg^{2+} from lakes, streams, rivers and groundwater for the protection of human health.

With the advancement of science and technology, a variety of technologies have been developed to remove mercury ions from wastewater (coagulation, membrane filtration, flocculation, precipitation, ion exchange and adsorption, etc.) [12–15]. Compared to other Hg^{2+} removal technologies, adsorption, due to its low cost, simplicity and ease of operation, is considered as one of the most promising Hg^{2+} removal technologies [16]. Several types of adsorbent were reported, including activated carbon, zeolite and clay [17,18]. Meanwhile, functional materials including multilayer magnetic nanoparticles, metal organic frameworks(MOFs), layered dihydroxides, MoS_2 nanosheets and modified lignocellulosic materials have been applied to remove Hg^{2+} from water [19–26]. Practical applications are limited, because of the low adsorption capacity and long adsorption time of conventional adsorbents, the selectivity of heavy metals is poor and cannot be recycled. Therefore, it is very important to study the methods for reduction of

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Thio-groups decorated covalent triazine polyamide (TTPA) for Hg^{2+} adsorption: Efficiency and mechanism

Chaoji Xiong [a], Hao Wang [a], Lihua Deng [a], Ran Liang [a], Chenhua Wu [a], Wei Wu [b,*], Xiaoping Rao [a], Qian Chen [c,*]

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ARTICLE INFO

Editor: Yongbo Liu

Keywords:
Thio-groups
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ABSTRACT

In this work, two thio-modified covalent triazine polyamides, **TTPA-1** (1:1:1) and **TTPA-2** (2:1:1), were successfully synthesized from the dietary seasoning 4-aminothiophenol, and applied to the adsorption of Hg^{2+} in the aqueous solution. We have systematically investigated the factors that can affect the adsorption process, such as the dosage of the adsorbent, the solution's pH, the temperature of the binary metal solution, the initial concentration of the ions, the pH, the co-existing substances, and the desorption. The pseudo-second-order kinetic model can describe the adsorption of Hg^{2+} well, and the equilibrium adsorption time is 180 min, respectively. The most appropriate adsorption isotherm model is Langmuir, and the maximum Hg^{2+} adsorption capacities calculated at 293 K are 649.7 (**TTPA-1**) and 617 (**TTPA-2**) mg g^{-1}. Preparation experiments have shown that it can be reused more than 10 times without any loss. The adsorption mechanism of **TTPA-1** (**2**) was elucidated by combining experimental results (physical characterization (SEM and EDS, etc.) and the density functional theory (DFT) calculations). These results indicate that **TTPA-1** (**2**) could have a good potential for the removal of the Hg^{2+} metal ions from wastewater.

1. Introduction

Mercury is regarded as one of the most toxic heavy metal pollutants, causing severe damage to the biosphere [1]. In the aqueous systems, mercury mainly exists in a positive divalent cation (Hg^{2+}), which can be easily transformed by organisms into toxic species, such as organic mercury [2]. The accumulation of mercury in the human body can lead to a range of diseases, such as neurological disorders, kidney failure, wasted illness, and even death [3]. Inorganic mercury compounds are found in a wide range of substances, including herbicides, fungicides, dyes, medicines and catalysts [4]. Mercury poisoning can occur in a number of ways, such as eating shrimp that has been exposed to mercury. Even if people are exposed to only a small dose of mercury, it can slowly build up in the body and reach high levels, which can lead to serious health problems and even death. Due to the accumulation of mercury in natural water as a result of industrial waste pollution, the removal of mercury has become extremely important. Mercury in water has prescribed levels [5] according to the World Health Organization (WHO), the concentration of mercury in drinking water should not exceed 2 μg L^{-1} [6]. The efficient Hg^{2+} adsorption technologies, which can reduce pollution by recovering valuable Hg^{2+} and make production more economical, are urgently needed.

So far, adsorption is considered as one of most efficient methods for the removal of mercury from aqueous solutions has attractive merits with ease and economical adsorbing materials. In this regard, many functional adsorbents, such as activated carbon, coal fly ash, natural zeolite and synthetic zeolite, have been proposed for the adsorption of pollutants in aqueous solutions [7–10]. In addition, the other elements materials, such as resorcin, poly (methyl methacrylate), SiO_2 and N_2/O_2, have also been reported [11,12]. However, these adsorbents have long adsorption kinetics and low adsorption capacity, etc. It is generally believed that Hg^{2+} can easily form the stable complex bonds with sulfur or nitrogen containing functional groups such as $-NH_2$, $-CN$, $-SH$ and $-S-$ [13–15]. Researchers therefore attach one or more these functional groups into the pores of the material [16], and it is found that the special heteroatoms (S and N atoms) easily coordinate strongly with Hg^{2+}

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发明人：[illegible]

专利号：ZL 2023 1 1157453.0

专利申请日：2023年09月08日

专利权人：西南林业大学

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院　　系：生命科学学院

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准考证号：530060211114819

考试时间：2021年6月

总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
459	172	159	128

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考试时间：—

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Identification of anti-photoaging components of Olea europaea leaves based on spectrum-effect relationship

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Keywords:
Olea europaea leaves
Anti-photoaging
Spectrum-effect relationship
High-speed countercurrent chromatography
Molecular docking

ABSTRACT

In this study, an efficient bioactive components of Olea europaea leaves extract (OLE), chemometrics analysis including bivariate correlation analysis and partial least squares regression were used to establish the relationships between the chromatograms and anti-photoaging effect of OLE samples. Firstly, the fingerprint of olive leaves extract was determined by high-performance liquid chromatography (HPLC). Photoaging models of HaCaT cells were established by UVB irradiation. The photoaging resistance of OLE was evaluated by cell viability using the MTT assay. Chemometrics analysis showed that components 14, 19, 20, 21, 24, and 26 might be the major anti-photoaging components of OLE. Furthermore, after preparation by HSCCC and NMR identification, compound 19 is luteolin and compound 26 is oleuropein. Oleuropein and luteolin were docked with collagenase (MMP-1), elastolysin (MMP-2), and gelatinase (MMP-9) respectively. The results showed that oleuropein and luteolin inhibited their activity by directly interacting with MMP-1, MMP-2, and MMP-9, thereby exhibiting anti-photoaging activity. The current bioassay and spectrum-effect relationships are prospective for accelerating sample quality with the active ingredients and for finding useful products from Olea and further understanding of the quality evaluation and quality control of olive samples.

1. Introduction

Excessive ultraviolet radiation (UV) exposure can cause damage to the human body, such as skin inflammation, premature skin aging, and so on [1,2]. The major reasons of photoaging are wrinkles, erythema, hyperpigmentation, oxidative stress, inflammation, and DNA damage [3]. About 5 million people are treated for skin cancer mainly caused by photoaging each year in the United States [4]. Biologically speaking, UVB could promote cytokines and crosslinks, up-regulate matrix metalloproteinases (MMPs), change cell composition and extracellular matrix (ECM) [5,6]. As a result, in recent years, various anti-photoaging strategies have been proposed to protect skin health [7–9]. Among them, the use of natural active components has become a research hotspot with powerful anti-photoaging activity, such as saponins [10], polyphenols [11], peptides [12], and polysaccharides [13,14]. These studies have shown that nutritional supplements have the effect of maintaining skin health and delaying skin aging.

Olea europaea L. (family: Oleaceae), native to the Mediterranean, is an

Abbreviations: OLE, Olea europaea leaves extract; HPLC, High performance liquid chromatography; MMP-1, Collagenase; MMP-2, Gelatinase; MMP-9, Gelatinase; MMPs, Matrix metalloproteinases; ECM, Extracellular matrix; HaCaT, Human transformed keratinocytes; HPLC, Orthogonal partial least squares; HSCCC, High-speed countercurrent chromatography; NMR, Nuclear magnetic resonance; PBS, Phosphate buffer solution; MTT, 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide; DMSO, Dimethyl sulfoxide; UVB, Ultraviolet B; PDB, Protein Data Bank; MS, Molecular dynamics; ANOVA, Analysis of variance; VIP, Variable importance projection.

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西南林业大学研究生成绩单

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入学年月	2021-09-01		毕业年月	[illegible]		学制	3

类别	课程名称	学时数	学分	开课学期	成绩	备注
学位课	食品质量与安全控制专题	32	2.0	1	94.00	94.00
	食品加工与贮运专题	48	3.0	1	92.00	92.00
	食品产业信息与网络安全	32	2.0	1	85.00	85.00
	新时代中国特色社会主义理论与实践（专硕）	36	2.0	1	85.00	85.00
	英语	64	3.0	1	77.00	77.00
	自然辩证法概论（专硕）	18	1.0	1	87.00	87.00
	食品安全案例	32	2.0	1	90.00	90.00
	现代农业创新与乡村振兴战略	32	2.0	1	82.00	82.00
	学位课小计		17.0			
非学位课	木本油料产品加工及废弃物资源化	32	2.0	1	90.00	90.00
	食品质量安全检测新技术进展	32	2.0	1	90.00	90.00
	非学位课小计		4.0			

学位（毕业）论文题目	[illegible]		
论文答辩时间		论文答辩成绩	
备注			

西南林业大学生命科学学院

西南林业大学研究生院 成绩专用章

全国大学英语四级考试
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准考证号：530060202111922
考试时间：2020年12月

总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
439	134	165	140

口　试

准考证号：---
考试时间：---

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教育部考试中心
证书专用章

Journal of Molecular Liquids

Eupatorium adenophorum Spreng leaves extract/potassium iodide as a highly sustainable inhibitor for the corrosion protection of steel in citric acid solution

Haidong Yang [a,b], Shuduan Deng [b,c], Dandan Shao [a,b], Ran Lei [a,b], Guanben Du [b,c], Xianghong Li [a,b,*]

ARTICLE INFO

ABSTRACT

1. Introduction

Steel is susceptible to be corroded by surroundings in our daily life and chemical industry. It is estimated that the global metallic corrosion costs in [illegible] was approximately [illegible] [1]. Adding the inhibitor to aggressive media is one of the most important strategies to prevent or eliminate the metallic corrosion [1,2], which has the merits of low additive dosage, fast efficiency and easy production. However, the vast majority of the common inorganic inhibitors and organic synthetic inhibitors have various limitations, such as highly toxic, costly, complex synthetic route and ecologically pollution [3–5].

Nowadays, plant extract has been widely tested as the corrosion inhibitor due to the abundant advantages of rich natural resource, eco-friendly, low cost and biodegradable [6], which turns to be a new hot topic in the field of the corrosion and protection of metallic materials in these recent years. A great deal of plant extracts have been reported as effective inhibitors to retard the corrosion of metallic materials in different corrosive media [7,8], especially for steel in acid media, for instance,

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溴代十六烷基吡啶对冷轧钢在柠檬酸中的缓蚀性能

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摘 要：[illegible]

关键词：[illegible]

中图分类号：TQ 047.6；TQ 113.3 **文献标识码**：A **文章编号**：1671-3206(2022)09-2575-07

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Inhibitive action of hexadecylpyridinium bromide on cold rolled steel in citric acid solution

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Abstract: The inhibition effect of hexadecylpyridinium bromide (HDPB) on cold rolled steel (CRS) in 0.10 mol/L $H_3C_6H_5O_7$ solution was studied by weight loss method, electrochemical impedance spectroscopy (EIS), potentiodynamic polarization curves and scanning electron microscope (SEM). The results indicate that HDPB the inhibition efficiency of 50 mg/L HDPB is up to 83.3% at 20 ℃. The inhibition efficiency was positively correlated with concentration, while negatively correlated with temperature. The adsorption of HDPB on CRS surface is in accordance with Langmuir adsorption isotherm. The standard adsorption Gibbs free energy (ΔG^0) values at different temperatures are within −34 ~ −29 kJ/mol. The adsorption process is an exothermic reaction accompanying with the decrease of standard adsorption entropy (ΔS^0). HDPB is a mixed type inhibitor, and the corrosion current densities of both cathodic and anodic reactions become much lower with an increase of inhibitor concentration. Nyquist diagram is composed of a capacitive loop followed by an inductive loop, and the charge transfer resistance significantly increases with the addition of HDPB. SEM micrographs indicate that HPDB can efficiently slow down the corrosion degree of CRS surface attacked by the aggressive media of citric acid.

Key words: hexadecylpyridinium bromide; steel; inhibition; citric acid; adsorption

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紫茎泽兰叶提取物与 KI 复配在柠檬酸介质中对冷轧钢的协同缓蚀性能

杨晨芳[1,2]，李向红[1,2*]
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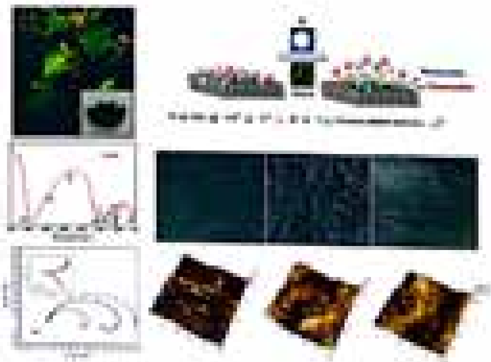
摘 要： 植物提取物缓蚀剂具有成本低、环境友好、资源丰富等突出优点。然而，为了进一步提高植物缓蚀剂的缓蚀作用，碘化钾（KI）总是与植物提取物结合使用，有望产生协同缓蚀作用。为此，通过失重法和电化学技术研究了紫茎泽兰叶提取物（EASLE）和 KI 复配缓蚀剂在柠檬酸（$H_3C_6H_5O_7$）介质中对冷轧钢（CRS）的缓蚀性能，采用扫描电子显微镜（SEM）和原子力显微镜（AFM）对 CRS 表面的微观形貌和粗糙度进行了检测。采用傅里叶变换红外光谱（FTIR）、紫外可见分光光度法（UV-vis）以及高效液相色谱法（HPLC）对 EASLE 主要有效成分和缓蚀机理进行了深入分析。结果表明，EASLE 或 KI 在柠檬酸溶液中均有缓蚀效果，最大缓蚀效率分别为 74% 和 34%；当 EASLE 与 KI 混合成复配缓蚀剂使用时，缓蚀效果显著增加，缓蚀率可达 92%，二者混合存在显著的协同作用。EASLE、KI 和 EASLE/KI 的吸附行为均遵循 Langmuir 吸附等温线。较单独的 EASLE、KI，EASLE/KI 两者复配后的平衡常数 K 增大，且标准吸附吉布斯自由能（ΔG^0_{ads}）的绝对值均在 25 kJ mol^{-1}~31 kJ mol^{-1}，吸附过程涉及物理和化学两种吸附类型。KI 的加入促进了 EASLE 在 CRS 表面的吸附。动电位极化曲线表明，添加 EASLE 主要抑制阴极反应，而 EASLE/KI 复配缓蚀剂同时抑制阴、阳两极反应，且阴极作用增强。Nyquist 图阻抗谱为在高频区一个电容回路，低频区一个电感回路，EASLE/KI 复配后电荷转移电阻增大，双电层电容降低。SEM 和 AFM 结果也证实 EASLE/KI 复配缓蚀剂的表面的缓蚀协同作用显著改善了酸溶液对 CRS 表面的腐蚀。EASLE 中的主要有效成分是绿原酸、咖啡酸和阿魏酸等系列黄酮物质。

关键词： 缓蚀；协同作用；吸附；植物提取物



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入学年月	2022-09-01	毕业年月		2025-06-30		学制	3

类别	课程名称	学时数	学分	考试方式	成绩	备注
学位课	生物质资源化学与技术		2.0	1	84.00	
	高等数理统计		2.0	1	84.00	
	自然科学前沿概论		1.0	1	91.00	
	专业英语		2.0	1	84.00	
	现代分析技术		2.0	1	84.00	
	高级木工		2.0	1	85.00	
	试验设计与数据处理		2.0	1	85.00	
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	园艺概论		2.0	1	78.00	
	现代园林景观设施		2.0	1	88.00	
	现代园林学前沿		2.0	1	86.00	
	英语口语		0.5	1	75.00	
	学位英语		0.5	2	71.00	
	英语写作		0.5	2	77.00	
	英语精读		2.5	2	78.00	
	中国特色社会主义理论与实践研究		2.0	2	86.00	
	英语听力		0.5	2	74.00	
	学位必修小计		24.0			

学位（毕业）论文题目	基于地下管线探测的城市道路塌陷风险评估研究		
论文答辩日期		论文答辩成绩	
备注			

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准考证号：530060221208323
考试时间：2022年6月

总分	听力（35%）	阅读（35%）	写作和翻译（30%）
428	141	168	119

口　试

准考证号：--
考试时间：--

等级	--

成绩报告单编号：221253006000147

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教育部教育考试院 证书专用章

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Development of easy-handled, formaldehyde-free, high-bonding performance bio-sourced wood adhesives by co-reaction of furfuryl alcohol and wheat gluten protein

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Keywords:
Bio-sourced wood adhesive
Bio-sourced adhesive, gluten proteins (GPRO)
Furfuryl alcohol (FA)
p-Toluenesulfonic acid (p-TSA)

ABSTRACT

Bio-sourced wood adhesives are an alternative of avoiding the petroleum-derived fossils used today in the timber industry, inspired by the classical furfuryl alcohol (FA) and condensed polycondensation strategy, a convenient preparation method is proposed for developing wood adhesives derived from sustainable hydrolyzed wheat gluten proteins (GPRO) and furfuryl alcohol (FA). The obtained GPRO-FA wood adhesives show a certain non-volatiles content and initial viscosity. The interactions mechanism of GPRO and FA is suggested based on the analyses of FT-IR, ^{13}C NMR, and MALDI-TOF spectra. It is found that the reaction between the free thiol groups (-SH) contained in GPRO and the crosslinking of the GPRO amino group by the FA hydroxymethyl groups, ensured to help heighten the storage life of the adhesives. The adhesive network build-up by FA self-polymerization promotes an excellent bonding performance and resistance to water immersion. The products obtained from the reactions between GPRO and FA improve the adhesive network level of crosslinking, which enhances the performance of the adhesive. Moreover, the GPRO-FA wood adhesives shows outstanding and stable strength that exceeds the China National Standard GB/T 9846-2015, ≥ 0.7 MPa requirements for veneer-grade plywood (type I). This work has produced novel research concerning high-bonding eco-friendly wood adhesives. This research provides a method for preparation of sustainable, environmentally friendly wood adhesive with high performance.

1. Introduction

Over 90% of the currently used wood adhesives are formaldehyde-based and are mostly refined via petrochemicals and the raw materials of carcinogenic risk [1–3]. These drawbacks hindered, including strong wood bonding performance and the use of low-cost starting materials, have resulted in their widespread utilization. However, health concerns from consumers and environmental risks by several governing bodies have promoted the development of formaldehyde-free or formaldehyde-based wood adhesives [4,5].

Numerous biomass resources, including lignin [6–8], cellulose [9–11], starch [12–15], tannin [16–17], and plant proteins [18–20], have been utilized to prepare bio-sourced wood adhesives. Among them, plant proteins have attracted much attention of researchers when used for preparation of wood adhesives due to their natural origin, ease of modification, renewability, abundance, and biodegradability [21]. However, their inherent hydrophilicity, together with insufficient intermolecular crosslinking leads to inferior bonding performance and increased water susceptibility [22]. Several strategies, including molecular modification of proteins [23–25], use of crosslinkers (or both synthetic resins copolymerization [26–28], biomaterials design [29,30], and protein denaturation [31,32] have been considered for improving

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International Journal of Adhesion and Adhesives

Camellia oleifera shell powder and palm kernel meal as an environmentally-friendly, low-cost compound filler in MUF adhesive for plywood preparation

Zhongyong Yang, Zhigang Duan, Shi Yan, Haizhu Wu, Hui Huang, Lei He, Hisham Essawy, Henning Huang, Xiaojian Zhou, Xinyi Chen

ARTICLE INFO

ABSTRACT

[illegible]

1. Introduction

[illegible]

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考试时间：2022年12月

总分	[illegible]	[illegible]	[illegible]
442	141	158	143

口　试

准考证号：--
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等级	--

成绩报告单编号：222153006000483

教育部教育考试院

校验码：IDDB DGCV PPHF AZ2S

DOI: [illegible]
[illegible]

桉木刨花板及其干刨花挥发性成分和气味特征分析

[illegible]
[illegible]

摘要： [illegible] (VOCs) [illegible] (HS-SPME-GC-MS) [illegible] (ROAV) [illegible] 103、97、104 种 VOCs [illegible]

关键词： [illegible]
中图分类号： [illegible]　**文献标志码：** A　**文章编号：** [illegible]

VOCs Analyses and Odor Characteristics of *Eucalyptus* Wood Particleboard and Its Dried Strands

[illegible]
[illegible]

Abstract: In order to clarify the content and odor characteristics of volatile organic compounds (VOCs) from *Eucalyptus* wood particleboard and its surface and core layer dried strands, their VOCs components and odor characteristics were evaluate by using a headspace solid-phase microextraction gas chromatography-mass spectrometry (HS-SPME-GC-MS) and relative odor activity value (ROAV). The results showed that 103, 97 and 104 VOCs including aromatic hydrocarbons, alkanes, aldehydes, ketones, alkenes, alcohols and other compounds, were identified in *Eucalyptus* wood particleboard and two dried strands, respectively, with the highest content of olefin-

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第 1 作者： [illegible]
通信作者： [illegible]

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学科专业	[illegible]			[illegible]	[illegible]		
入学年月	[illegible]	毕业年月		[illegible]		学制	[illegible]

类别	课程名称	学时数	学分	开课学期	成绩	备注
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	[illegible]	32	2.0	1	92.00	92.00
	[illegible]	[illegible]	[illegible]	1	79.00	79.00
	[illegible]	32	2.0	1	89.00	89.00
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非学位课	[illegible]	32	2.0	1	94.00	94.00
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	[illegible]	32	2.0	1	87.00	87.00
	非学位课小计		[illegible]			
学位（毕业）论文题目	[illegible]					
[illegible]			[illegible]			
备注						

全国大学英语四级考试
成绩报告单

CET

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准考证号：419020162100512
考试时间：2016年12月

总分	听力	阅读	写作和翻译
475	171	172	132

口　试

准考证号：--
考试时间：--

等级	--

成绩报告单编号：162141902000465

教育部考试中心
证书专用章

基于纳米压印技术的仿生超疏水 TiO_2 /FAS-17 木材研制

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摘要：[illegible]

关键词：木材；二氧化钛；超疏水；自清洁；机械稳定性
中图分类号：TS652；TB306 **文献标识码**：A
文章编号：1671-5470(2020)02-0272-05
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Preparation of a biomimetic superhydrophobic TiO_2/FAS-17-wood based on nanoimprint lithography

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Abstract: To improve the durability of wood, a low-adhesive superhydrophobic coating was manufactured through a process which combined hydro-deposition and nanoimprint lithography and subsequent modification with fluoroalkyl silane. The micromorphology, chemical composition and surface structure of the TiO_2/FAS-17 wood were further examined by scanning electron microscope, energy disperse spectroscopy and x-ray diffraction. The results showed that the biomimetic wood presented a papillary microstructure which resembled lotus leaf. Its contacting angle was 155° and the roll angle was 6°, which was close to that of lotus leaf for the latter one. The stability tests by contact angle and roll angle with static water, and sand abrasion test confirmed that the surface of the biomimetic material is of high robustness.

Key words: wood; TiO_2; superhydrophobicity; self-cleaning; mechanical stability

木材作为一种可再生的天然有机高分子材料，广泛应用于人类生活的方方面面，如木结构建筑、室内装饰、家具、工矿、国防、乐器以及交通等[1-2]。但木材自身固有的特性使其存在一些缺陷，包括尺寸稳定性差、易被细菌（真菌）侵蚀、霉变、易燃烧、易开裂和易生物降解等[3-4]。由于这些缺陷的存在，在实际应用中很大程度上限制了木材的使用范围。目前，已对自然界生物体的结构、功能、行为、视觉等进行仿生研究[5-6]，充分利用木材自身所具有的独特天然结构与固有属性，将其与纳米技术、分子生物学、界面化学、物理模型等相结合，制备出具有奇异功能的仿生木质基新型材料[7-8]。通常采用的方法包括化学刻蚀法、激光刻蚀法、溶胶-凝胶法、模板法、自组装法、水热结晶法等[9-11]。

由于纳米二氧化钛性能稳定，并具有抗光、电、化学等性能，能够对水和空气污染进行催化，可达到绿色、环保、无毒、无污染[12-13]的目的。在木材表面通过水热沉积负载纳米 TiO_2，同时结合纳米压印技术将仿生物功能界面的微纳米形貌结构，是一种简单、方便、无毒无污染的木材表面改性技术，可获得尺寸稳定性

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西南林业大学研究生成绩单

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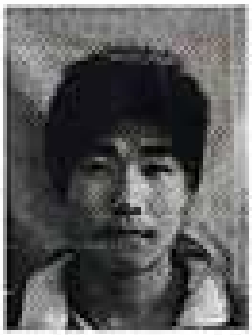

总分： 436

听力 (35%)	阅读 (35%)	综合 (10%)	写作和翻译 (20%)
133	164	43	96

成绩单编号：091132036001001

教育部高等教育司

委托发布单位：全国大学英语四、六级考试委员会

考委会网址：www.cet.edu.cn

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鬼点灯药材脂溶性成分及抗氧化活性研究*

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摘要：目的：研究鬼点灯药材脂溶性成分的组成和抗氧化活性。方法：采用气相色谱-质谱联用法对鬼点灯药材脂溶性成分进行分析和鉴别，并采用 DPPH 自由基清除法和普鲁士蓝法测定其抗氧化活性，以维生素 C 作为阳性对照。结果：共检出 60 个化学成分，鉴定出 52 个主要化学成分，包含 6 类化合物及其衍生物，其中棕榈酸（21.19%）、亚麻酸（12.92%）、亚油酸（10.83%）、2,7-二甲基辛烷（5.86%）、9(R)-9-甲基-癸烯（3.91%）等为鬼点灯药材脂溶性成分的特征成分。鬼点灯药材脂溶性成分对 DPPH 自由基的 IC_{50} 为 298.49 μg/mL，对 ABTS 自由基的 IC_{50} 为 140.98 μg/mL，对总抗氧化能力 IC_{50} 为 70.40 μg/mL，对 Fe³⁺ 还原能力 $EC_{0.5}$ 为 70.40 μg/mL。结论：鬼点灯药材脂溶性成分具有较强的抗氧化活性，初步确定其为鬼点灯药材抗氧化活性的物质基础。

关键词：鬼点灯药材；脂溶性成分；气相色谱-质谱联用法；抗氧化活性

Liposoluble Constituents and Antioxidant Activity of *Rubrioxpreseum Tenellum*

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Abstract: Objective: To study liposoluble constituents and antioxidant activity of *Rubrioxpreseum tenellum*. **Methods**: The liposoluble constituents (petroleum ether extract) of *Rubrioxpreseum tenellum* were screened by gas chromatography-mass spectrometry (GC-MS), and identified with reference to the data in the standard mass spectrometric library (NIST08 and NIST11). Free radical scavenging test was used to detect the antioxidant activity of *Rubrioxpreseum tenellum* with vitamin C as the positive control. **Results**: A total of 60 chemical constituents were detected and 52 main chemical constituents were identified. The chemical constituents with higher content included palmitic acid (21.19%), linoleic acid (12.92%), linolenic acid (10.83%), 2,7-dimethyloctane (5.86%), decanal (3.91%), etc. The 50% inhibitory concentration (IC_{50}) of liposoluble constituents of the medicinal material on DPPH free radical was 298.49 μg/mL, the IC_{50} of ABTS free radical was 140.98 μg/mL, and the IC_{50} of positive control was 25.90 μg/mL, and 21.20 μg/mL, respectively. **Conclusion**: The liposoluble constituents of *Rubrioxpreseum tenellum* are mainly fatty acids, fatty alcohols and aromatic and have constituents have strong antioxidant activity.

Key words: *Rubrioxpreseum tenellum*; petroleum ether extract; liposoluble constituents; GC-MS; antioxidant activity

鬼点灯为紫草科假紫草属植物[1]，主要分布于云南、广西、贵州、四川等地[2]，别名[illegible]，具有[illegible]等功效[3]。

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[1] 王凡宏，陈俊平，李　波，等．"空谷幽兰"-仙女报春的种质资源特征特性调查初报[J]．世界科学技术-中医药现代化，2021，23(7)：2047-2053.
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[3] 朱思明，孟　泉，王红平，等．中草药毛茛科近缘种生药学鉴别及地理分布概况[J]．贵州农业科学，2011，39(8)：183-185.
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[5] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[6] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[7] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[8] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[9] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[10] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[11] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[12] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[13] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[14] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[15] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[16] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[17] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.
[18] 李　波，王凡宏，陈俊平，等．报春花属植物资源调查及其在园林绿地中的应用[J]．安徽农业科学，2021，49(3)：71-73.


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发 明 名 称：
专 利 号：ZL 2022 1 0440087.5
局长
申长雨

发明专利证书

发明名称：[illegible]

发明人：[illegible]

专利号：ZL 2022 1 0430082.8

专利申请日：2022年04月22日

专利权人：宿迁市中医院

地址：[illegible]

授权公告日：2023年11月03日　　　　授权公告号：CN 114786048 B

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局长
申长雨

第1页（共2页）

其他事项参见续页

广西中医药大学硕士研究生报名单

全国大学英语四级考试
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考试时间：2023年3月

总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
428	136	139	153

口　试

准考证号：--
考试时间：--

等级	--

成绩报告单编号：222141002005613

教育部教育考试院
证书专用章

校验码：KFB3 FAC2 9QFF AE36

Environmental Chemistry Letters
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REVIEW ARTICLE

Phytoremediation of contaminants in urban soils: a review

Yachen Zhu[1] · Weiping Gu[1] · Hanyin Li[1] · Su Shiung Lam[2,3] · Meenakshi Verma[4] · Hui Suan Ng[5] · Christian Sonne[6,7] · Rock Keey Liew[2,7] · Wanxi Peng[1]

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Abstract
Accelerated urbanization has induced the accumulation of toxic substances in urban soils, calling for sustainable remediation methods such as phytoremediation. Here, we review the phytoremediation of contaminants in urban soils with focus on species selection for remediation, mechanisms of remediation, and strategies for enhancing remediation. Plants can remove up to more than 95% of contaminants in soils. The choice of plants varies depends on the specific pollutants present in the soil. For instance, *Rhizon pilosa* L. can be utilized to remove cadmium, while *Polycarpaea nivosa* is effective in removing nickel and lead. The mechanisms of phytoremediation involve absorption, translocation, stabilization, and volatilization of contaminants by plants. The phytoremediation efficiency can be enhanced by the addition of microorganisms, chelating agents, and biochar in soils, and by genetic engineering and nanotechnology.

Keywords Phytoremediation · Remediation efficiency · Microbiological · Green chelate · Foliar spray · Multi-process phytoremediation

Introduction

Social development has unfortunately been accompanied by irreversible natural resource destruction. The pursuit of a higher standard of living leads to the generation of considerable amount of waste, which has detrimental repercussions for the soil environment. The expansion of urban area encroaches upon previously forested and agricultural lands, thereby exacerbating the problem (Qiu et al. 2019; Shahbaz et al. 2020). Given the contamination of urban soil has the potential to cause illness, particularly to those with weakened immune systems such as children (Mielke 2016; Wu et al. 2016), it is paramount to investigate viable solutions to address this issue. Table 1 shows the impact of soil contaminants on human health. Phytoremediation has emerged as a promising approach to address complex and diverse pollutants in urban soil. This technique can play an instrumental role in ensuring ecological equilibrium and mitigating the negative effects of urbanization.

Yachen Zhu and Weiping Gu have contributed equally to this work.

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学期	课程名称	课程类别	学分	成绩	任课老师
第1学期	森林生态理论与应用	专业基础课	1.5	88.0	吴明作
	现代树木生理学	学位课	1.5	86.0	胡霞
	林业科技进展（案例分析）	专业选修课	2.0	86.0	胡霞
	林木遗传改良与品种工程	学位课	1.5	90.0	彭方仁
	现代森林培育理论与技术	学位课	1.5	86.0	胡霞
	经济林产品质量检验	专业选修课	2.0	84.0	张文彬
	中国特色社会主义理论与实践研究	公共必修课	2.0	88.0	梁丹
	科技创新方法	学位课	1.5	83.0	王艳梅
	外国语	公共必修课	3.0	83.0	张翠
	森林药物资源开发与利用	专业选修课	2.0	80.0	彭方仁
	林业经济与产业规划	专业选修课	2.0	85.0	闫东锋
	森林资源与林业可持续发展	学位课	1.5	88.0	闫东锋
	自然辩证法概论	公共必修课	1.0	89.0	王丽荣
第2学期	实践环节	实践环节	6.0	93.0	
应修学分	29.0	已修学分	29.0		

研究生院（盖章）