

含木质素纳米纤维素 燃紫外屏蔽膜的制备与表征

向璐^{1,2}, 王又梅^{1,2}, 齐锦秋^{1,2}, 谢九龙^{1,2*}

(1 四川农业大学林学院, 四川成都 611130; 2 四川省教育部木材工业与家具工程重点实验室, 北京 100084)

摘要: 面对石油基塑料造成的严重污染, 多功能的环保生物质塑料受到学者们的关注。本研究使用简单的“一锅法”将含木质素纳米纤维素(LCN)、海藻酸钠(SA)、聚磷酸铵(APP)直接添加到聚乙烯醇(PVA)基体中制备了具有优异阻燃性和紫外屏蔽性的复合膜。XPS、FTIR 结果证明了 SA/APP 成功被引入到 PVA 膜中。与对照纯 PVA 膜相比, 添加了 LCN 的薄膜对 UVC、UVB 和 UVA 的紫外屏蔽能力均达到近 100%; 所制备阻燃改性紫外屏蔽膜的极限氧指数从 18.19% 增加到 38.48%, 燃烧强度明显减弱, 且具有离火自熄的效果, 且在热稳定性测试结果证明了薄膜的残余质量明显增加, 900 °C 时残余质量高达 29.70%; 另外, 还发现 SA 的添加可以改善 APP 与基质之间相容性差的问题。这为扩大 PVA 的应用范围和开发生物质基阻燃材料提供了一种绿色、简单、高效的思路。

Preparation and characterization of lignin-containing nanocellulose films with flame retardant and UV shielding properties

Lu Xiang^{1,2} You-Mei Wang^{1,2} Jin-Qiu Qi^{1,2} Jiu-Long Xie^{1,2*}

(1 College of Forestry, Sichuan Agricultural University, Chengdu, 611130, China; 2: Wood Industry and Furniture Engineering Key Laboratory of Sichuan Provincial Department of Education, Chengdu, 611130, China;)

Abstract: In light of the significant environmental impact of petroleum-based plastics, scholars have directed their attention towards multifunctional and eco-friendly biomass plastics. In this study, lignin-containing nanocellulose (LCN), sodium alginate (SA), and ammonium polyphosphate (APP) were directly added into a polyvinyl alcohol (PVA) matrix by a simple one-pot method to prepare composite films with excellent flame retardancy and ultraviolet (UV) shielding properties. The XPS and FTIR results demonstrated that SA/APP was effectively incorporated into the PVA film. In comparison to the pure PVA film, the UV shielding ability of the LCN-added film against UVC, UVB, and UVA reached nearly 100%. Additionally, the ultimate oxygen index of the prepared flame-retardant modified UV shielding film was increased from 18.19% to 38.48%, increased by 111.5%. Additionally, the film exhibited a self-extinguishing effect when removed from the source of ignition. The results of the thermal stability test demonstrated a notable increase in the residual mass of the film, reaching 29.70% at 900 °C. Furthermore, it was discovered that the addition of SA could improve the poor compatibility between APP and the substrate. This offers a sustainable, straightforward, and effective approach for broadening the utilization of PVA and developing biomass-based flame retardant materials.