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Phosphorylation of Natural Products for Flame Retardant Applications

A safe and environmentally responsible method transforms renewable carbon-containing materials into enhanced, non-halogenated flame retardants compatible with various polymer systems.

Current polymer flame retardant technologies consist mainly of halogenated moieties, such as brominated flame retardants. These moieties are added to polymers to help make them less flammable and are commonplace in plastics, textiles, and electrical/electronic equipment. Health and environmental concerns have been raised about such substances, specifically brominated flame retardants and their tendency to create formaldehyde, and therefore, alternatives are desired for industrial applications.

Researchers at Purdue University have developed a safe, environmentally responsible method for transforming carbon-containing materials into flame retardants via phosphorylation. These natural products, lignin, tannic acid, and natural oils, are all potential renewable feedstock; researchers were able to chemically modify them to enhance char formation and increase their compatibility with polymer systems, while exhibiting none of the safety issues faced with brominated flame retardants. Modified products have been characterized using techniques, such as nuclear magnetic resonance spectroscopy, thermogravimetric analysis, and fourier transform infrared spectroscopy, to determine the extent of modification and chemical changes during char formation and decomposition; the products' flame retardant characteristics can be determined using limited oxygen index and vertical burn tests.

Advantages:

-Enhanced char formation, translating to increased flame retardant property

-Environmentally responsible

Potential Applications:

Technology ID

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Category

Chemicals & Advanced Materials/Polymer Science & Smart Materials
Chemicals & Advanced Materials/Green & Bio-Based Chemistry
Materials Science & Nanotechnology/Advanced Functional Materials

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-Flame retardant polymer development

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