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Towards Suppression of Polycyclic Aromatic Hydrocarbons Leaching from Creosote-Treated Wood

CONFERENCE ABSTRACT

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Abstract

Creosote produced from coal-tar distillate is an archaic, highly toxic wood preservative commonly used today, predominantly in utilitarian applications (e.g., utility poles, railroad crossties, and marine pilings). Creosote consists of a mixture of carbon-based compounds, most of which are known human carcinogens, with high persistence to leaching and threatening groundwater and soil. As the total phase-out of creosote-treated wood is a long-term goal, the development of retroactive coatings to mitigate leaching is a high-priority environmental strategy. This study reports on the PAH leaching suppression efficacy of a poly(organosiloxane)-based nanocoating, designated Sol-186-3, that can be retroactively applied via spraying directly to creosote-treated wood substrates. The coating, composed of tetra-ethoxysilane, propyl-functional, and epoxide-functional alkoxysilanes, forms a matrix through sol-gel condensation. This coating provides a hydrophobic structure

capable of interacting with wood lignocellulosic sites and creating a siloxane network. The coating is proposed to reduce PAH leaching through physical encapsulation within a hydrophobic matrix and non-covalent interactions. Aqueous leaching tests, followed by UV-absorbance spectroscopy were conducted to evaluate immobilization efficiency. The results showed suppression of peaks characteristic of PAHs, and after 3 hours of leaching, Sol-186-3-treated samples had a 66% reduction in overall leachate compared to untreated creosote wood. Water-repellent efficiency, after extended immersion in water, was confirmed by conducting the test in accordance with ASTM D103. These findings confirm that poly(organosiloxane) nanocoatings can be used as a viable and environmentally friendly means of reducing toxic leaching from existing creosote-treated wood. Beyond utilization as a mitigator, the same chemical framework proves itself as a promising wood preservative alternative for creosote without entailing the harmful consequences.

Keywords: creosote, polyorganosiloxane, nanocoatings