Sleep De-Lighted: An Environmentally Friendly, Plant-Derived Flame Retardant Solution Targeted Towards Usage in Open-Cell, Flexible Polyurethane Foam

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The threat of fire is one of the most impactful adversaries terrorizing life on Earth today. Polyurethane foam, a common household insulator, is typically embedded with toxic, brominated flame retardant chemicals that are extremely harmful to humans and the environment. In order to solve both of these momentous issues, an environmentally friendly, plant-derived flame retardant solution has been proposed, developed and tested. The phosphorus triethyl ester of methyl 3,5-dihydroxybenzoate was synthesized primarily through a Fischer esterification and a modified Ferro's preparation of aralkyl dialkyl phosphonates and was employed in 500 samples of open-cell, flexible polyurethane foam at varying additive concentrations: 0.0%, 0.2%, 0.4%, 0.6%, and 0.8%. The specific heat capacities of each sample, in J/g°C, were found and calculated through isobaric calorimetry. A one-way analysis of variance (ANOVA) test was performed and the differences between the means of the specific heat capacities of each chemical concentration were found to be highly significant. A Fisher's Least Significant Difference post-hoc test was performed and the differences between the specific heat capacities of each individual concentration group were found to be highly significant as well. The phosphorus triethyl ester of methyl 3,5-dihydroxybenzoate is proposed chiefly as an insulator, with strong prospects in flame retardancy and fire resistance. As an additive in open-cell, flexible polyurethane foam, the developed chemical possesses good flame-retarding characteristics and therefore could be used in a variety of applications as one of the world's most promising environmentally friendly, plant-derived flame retardant solutions.

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