OFFICIAL ABSTRACT and CERTIFICATION

Enhancing the Flame Retardancy of Low Concentrations of Biodegradable Poly (vinyl alcohol) Hydrogels with Resorcinol Bis(diphenyl phosphate)

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Flame retardant components are necessities to a firefighter ' s protective gear, such that more eco-friendly advancements in this technology have become more pertinent in an effort to better ensure the safety of both firefighters and victims in fires. Conventionally, flame retardants have been created from only slightly biodegradable superabsorbent polymers with extremely high water content. Generally, these superabsorbent polymers are derived from acrylic acid and acrylamide and unless these are oligomers it is likely that they are not biodegradable. In lou of these facts, the primary goal of this research was to synthesize a biodegradable hydrogel flame retardant that is as efficient as its less environmentally friendly equivalents. To create the hydrogel samples we used a cyclic freezing and defrosting procedure consisting of 24 hours in a -20 degree Celsius freezer and then 1 hour of defrosting at room temperature 3 times for each set of samples. We derived from the FTIR results that hydrogen bonds were present in the PVA and RDP-PVA, and learned that the gels were mainly shear-thinning through the rheological studies. Overall samples with PVA as the hydrogel base with RDP-coated starch performed the best in terms of the completeness of the char layer formed. The temperature of the skin sample under the hydrogel was kept being below 65°C during the burning test. Additionally, the flame retardant hydrogel displayed clear shear-thinning. Thermal protective performance (TPP) tests were performed to evaluate heat transmission through the FR hydrogel when exposed to a continuous heat source, and results compared to the Stoll Curve which represents the heat level for causing a second-degree burn. The TPP test result showed that the poly(vinyl alcohol) flame retardant hydrogel provided a prolonged protection time.

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