# Reducing Plastic and Forever Chemical Pollution With a Biodegradable, Bio-Based Coating of Single Use Paper Products

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Single-use paper items used in food packaging like straws and food wrappers are often coated with plastic or polyfluoroalkyl substances (PFAS, also known as "forever chemicals") to make them water and grease resistant. However, these coatings linger in our environment and can negatively affect human health, ecosystems, and wildlife. The goal of this research was to create a cost-effective, biodegradable, bio-based, food-safe coating for single-use paper items that meets or exceeds the water resistance of PFAS coatings and that is comparable in cost. I found that a coating composed of 5% talc, 0.5% silica, and 94.5% lac that was then cured yielded greater water resistance than PFAS coating due to a reduction in surface energy and increased surface roughness. To evaluate various coatings, different types of coatings were applied to various paper samples, dried, and then weighed after being dipped in or soaked in water at various time intervals to determine the percent water absorption of the paper over time. Some of the samples were also cured to harden the coating film. I found that the optimal coating had 2.5 times lower water absorption than PFAS coated samples. The materials used in this study are food-safe, readily available, and only modestly more expensive than PFAS. The coating has the potential to replace the ~150K metric tons of PFAS and ~6 million metric tons of plastic produced annually for paper coating on a global basis, creating a sustainable alternative to harmful commercial coatings.

**Awards Won:**