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Title: Thermochemical Recycling of Waste Cotton at FIT

Abstract:

Textile waste presents a major burden on the environment, contributing to climate change and chemical pollution as toxic dyes and finishing chemicals enter the environment through landfill leachate. Moreover, the majority of textile waste reaching landfills is discarded clothing, which could be reused or recycled. Here we investigate environmentally benign thermochemical recycling of discarded cotton muslin for reintegration into a circular materials economy. The large majority of muslin used at FIT, a cotton weave that is heavily used to prototype draping and pattern making, is discarded. Finding a way to recycle this waste, here at FIT, will allow us to reduce our environmental footprint as a community. In a previous study, at 50 °C using low concentrations of acids and bases, the interfiber structures of woven cotton were degraded when treated with the following sequence of chemical treatment: citric acid, urea, sodium hydroxide, ammonium hydroxide, and sodium nitrate. Building on key insights on thermochemical degradation mechanisms yielded from this work, we developed a protocol to de-weave and de-spin cotton fabric into a lint suitable for spinning and subsequent weaving or knitting onto recycled textiles. Utilizing only a single chemical, sodium hydroxide, we have demonstrated a low toxicity method of thermochemically recycling cotton waste generated from the FIT community, built on fundamental tenets of green chemistry.