

## **Extraction and surface modification of cellulose fibers and its reinforcement in starch-based film for packaging composites**

### **ABSTRACT**

Background Cellulose extraction from gloss art paper (GAP) waste is a recycling strategy for the abundance of gloss art paper waste. Here, a study was conducted on the impact of ultrasonic homogenization for cellulose extraction from GAP waste to improve the particle size, crystallinity, and thermal stability. Results At treatment temperature of 75.8 °C, ultrasonic power level of 70.3% and 1.4 h duration, cellulose with properties of 516.4 nm particle size, 71.5% crystallinity, and thermal stability of 355.2 °C were extracted. Surface modification of cellulose GAP waste with H<sub>3</sub>PO<sub>4</sub> hydrolysis and 2,2,6,6-tetramethylpiperidine-1-oxyl radical (TEMPO) oxidation was done followed by starch reinforcement. Surface hydrophobicity and mechanical strength were increased for H<sub>3</sub>PO<sub>4</sub> hydrolysis and TEMPO oxidation starch–cellulose. No reduction of thermal properties observed during the treatment, while increment of crystallinity index up to 47.65–59.6% was shown. Neat starch film was more transparent, followed by starch–TEMPO film and starch–H<sub>3</sub>PO<sub>4</sub> film, due to better homogeneity. Conclusions The cellulose GAP reinforced starch film shows potential in developing packaging materials and simultaneously provide an alternative solution of GAP waste recycling.