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Toward Utilization of Agricultural Wastes: Development of a Novel Keratin Reinforced Soybean Meal-based Adhesive

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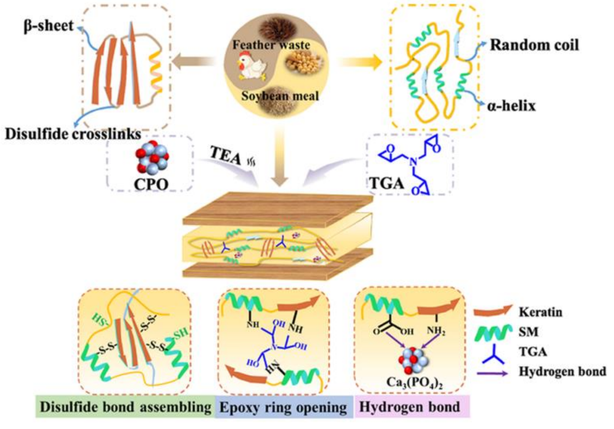
introduction

- Preparation of adhesive from agricultural waste: grafting of chicken feathers with soybean meal by novel mesoscopic strategy.
- Mechanically stronger due to biomineralization and organic polymerization process.
- Also, an epoxy crosslinking agent – TGA (triglycidylamine) was added for strong bonding.



Challenges

- Adhesives produced by petroleum lead to depletion in resources
- Price fluctuations in petroleum affects the production
- Sustainable development demanded
- The mechanical strength of only soymeal as an adhesive is not enough.

Why is this work important?

- Low-cost
- Bio-based
- Formaldehyde-free
- Effective conversion of raw material in agricultural & forestry waste

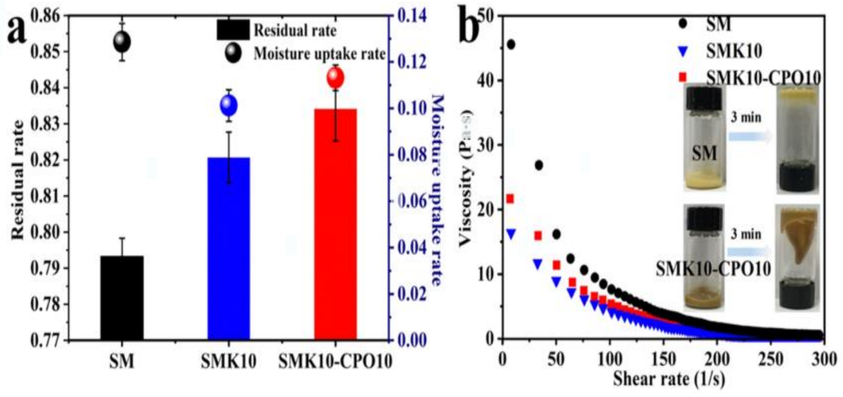
soymeal

- Already studied as a great adhesive
- Low price
- Renewable

Chicken feathers

- Mechanically strong
- Water resistance

Results and discussion



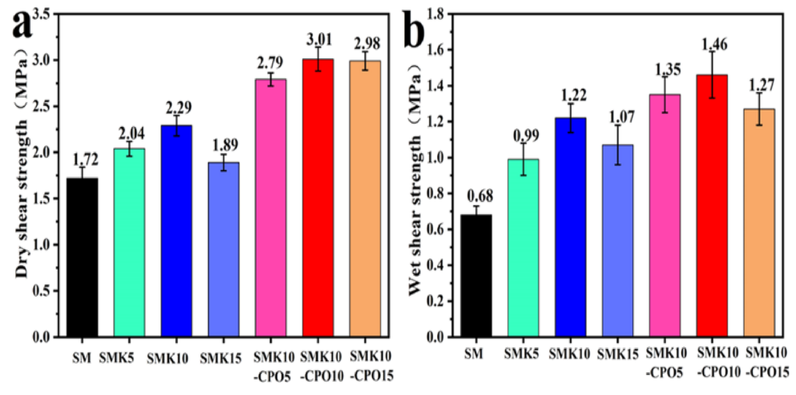
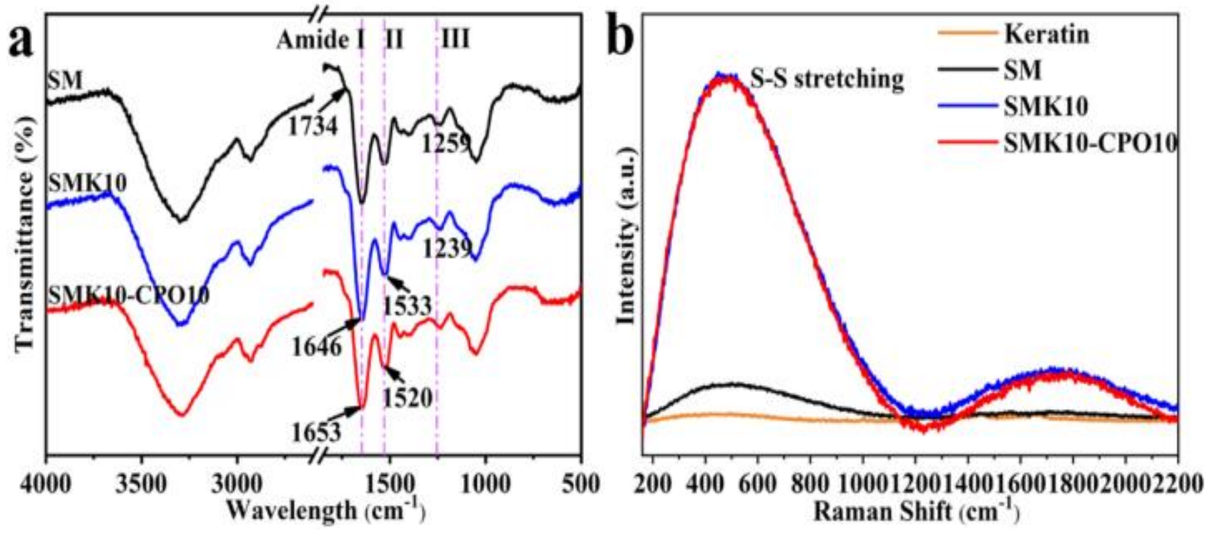
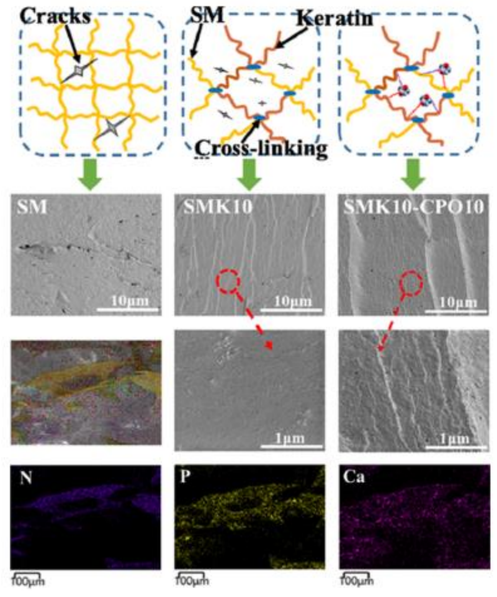


Table 2. Temperature of the Maximum Degradation Rate and Residue Weight Fraction for Different Cured Adhesive Samples

samples	$T_{10\%}$ [a] (°C)	$T_{30\%}$ [a] (°C)	$T_{50\%}$ [a] (°C)	T_{max} [b] (°C)	residual mass (wt %)
keratin	219.00	277.95	309.86	296.22	18.08
SM	243.63	290.14	345.76	289.61	31.25
SMK10	243.71	288.68	326.12	298.40	26.51
SMK10-CPO10	238.68	288.94	331.26	298.56	28.04





summary

- A stable disulfide cross-linked homogeneous network revealed
- CPO (Calcium Phosphate Oligomer) as a precursor, plays a vital role in the combination of SM and CF
- The highest dry as well as wet strength compared to other soymeal-based works.
- The amount of chemical cross-linking agent decreased by almost half.

Future and Acknowledgement

- **Reference** – Zianzhang Li. & Zhen Fang ACS Sustainable Chemistry and Engineering. 9(2021) 7630-7637