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

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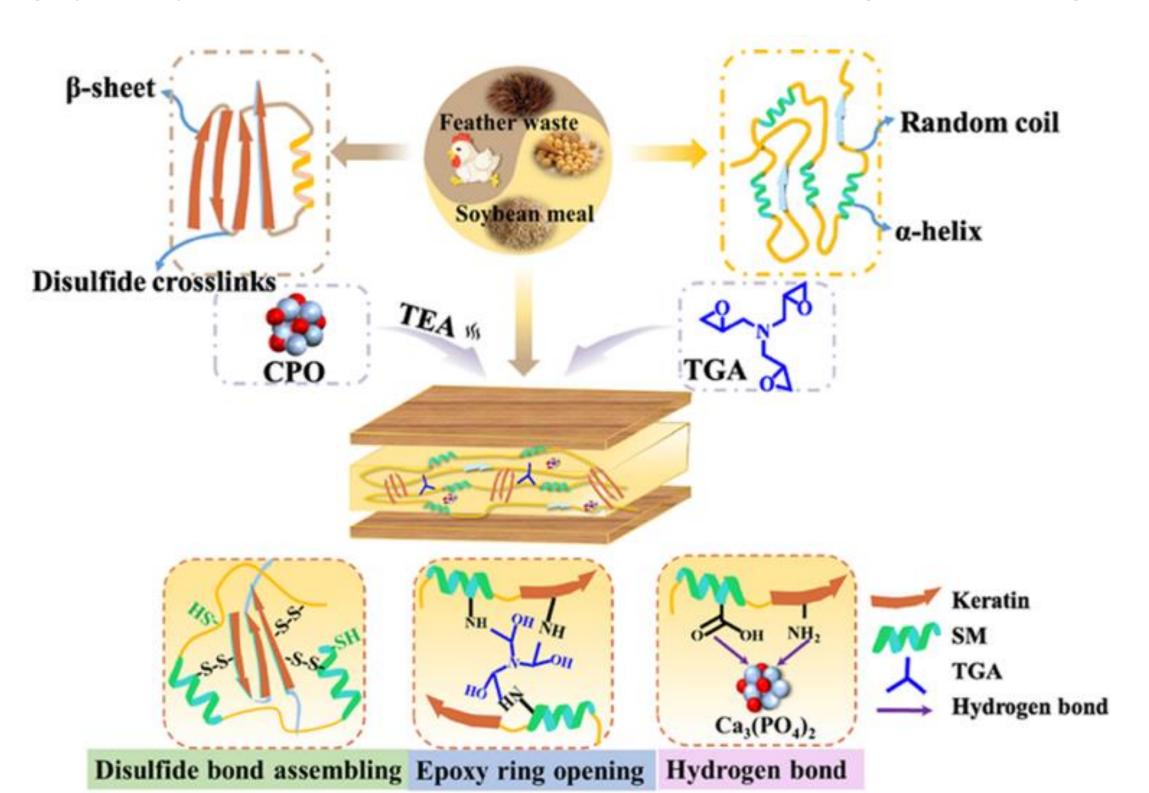
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# Toward Utilization of Agricultural Wastes: Development of a Novel Keratin Reinforced Soybean Meal-based Adhesive Vishwa D. Suthar, Ram K. Gupta, Pittsburg State University, Pittsburg, Kansas.

## 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

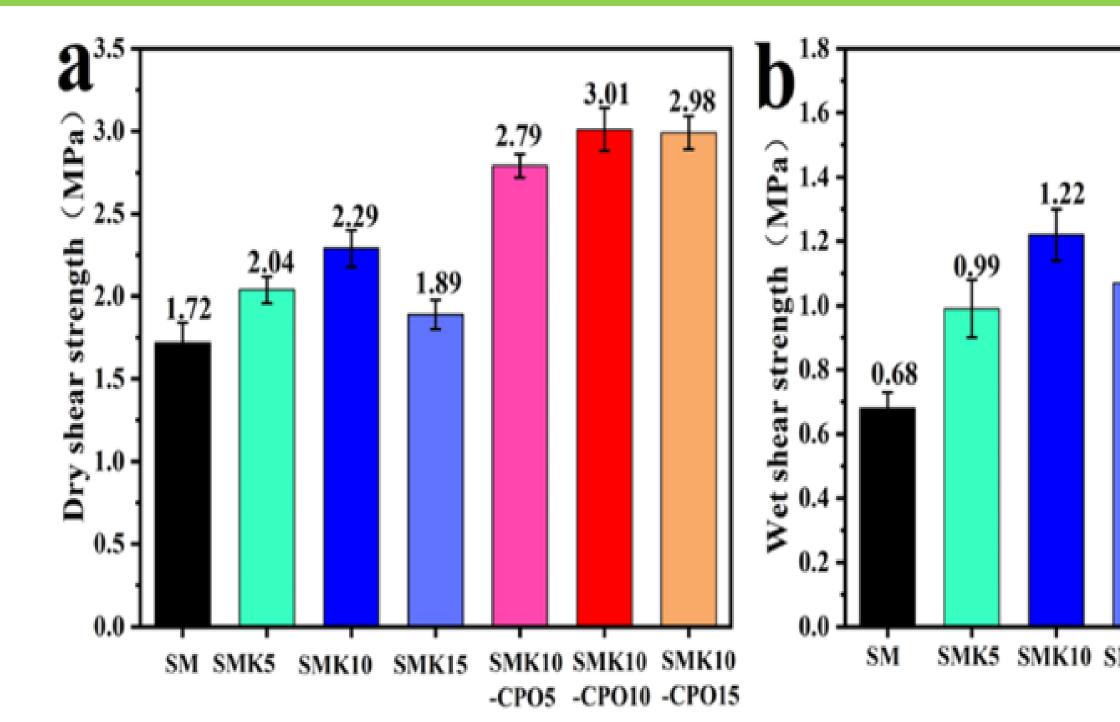
## soymeal

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

#### Chicken feathers

- Mechanically strong
- Water resistance

# Results and discussion Moisture uptake rate 0.12 ▼ SMK10 SMK10-CPO10 e 0.83 0.78 SMK10 SMK10-CPO10



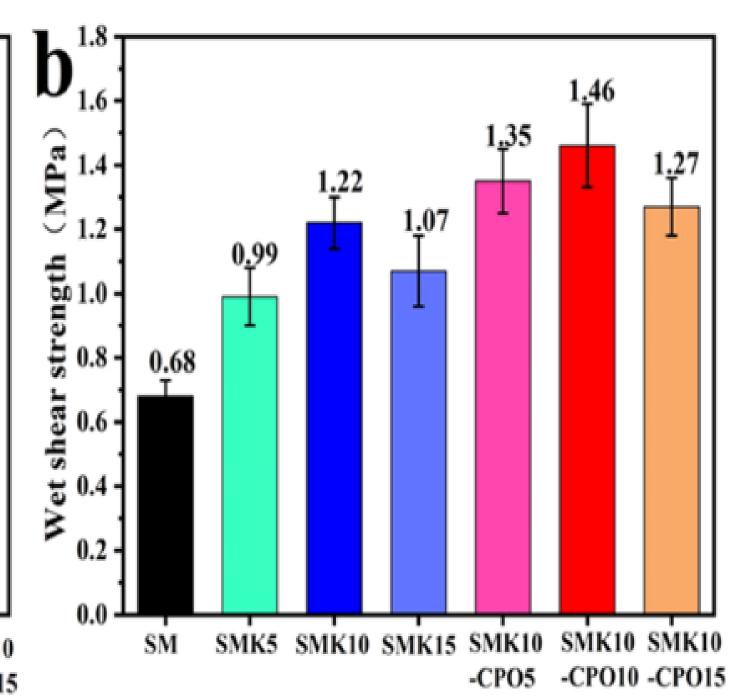
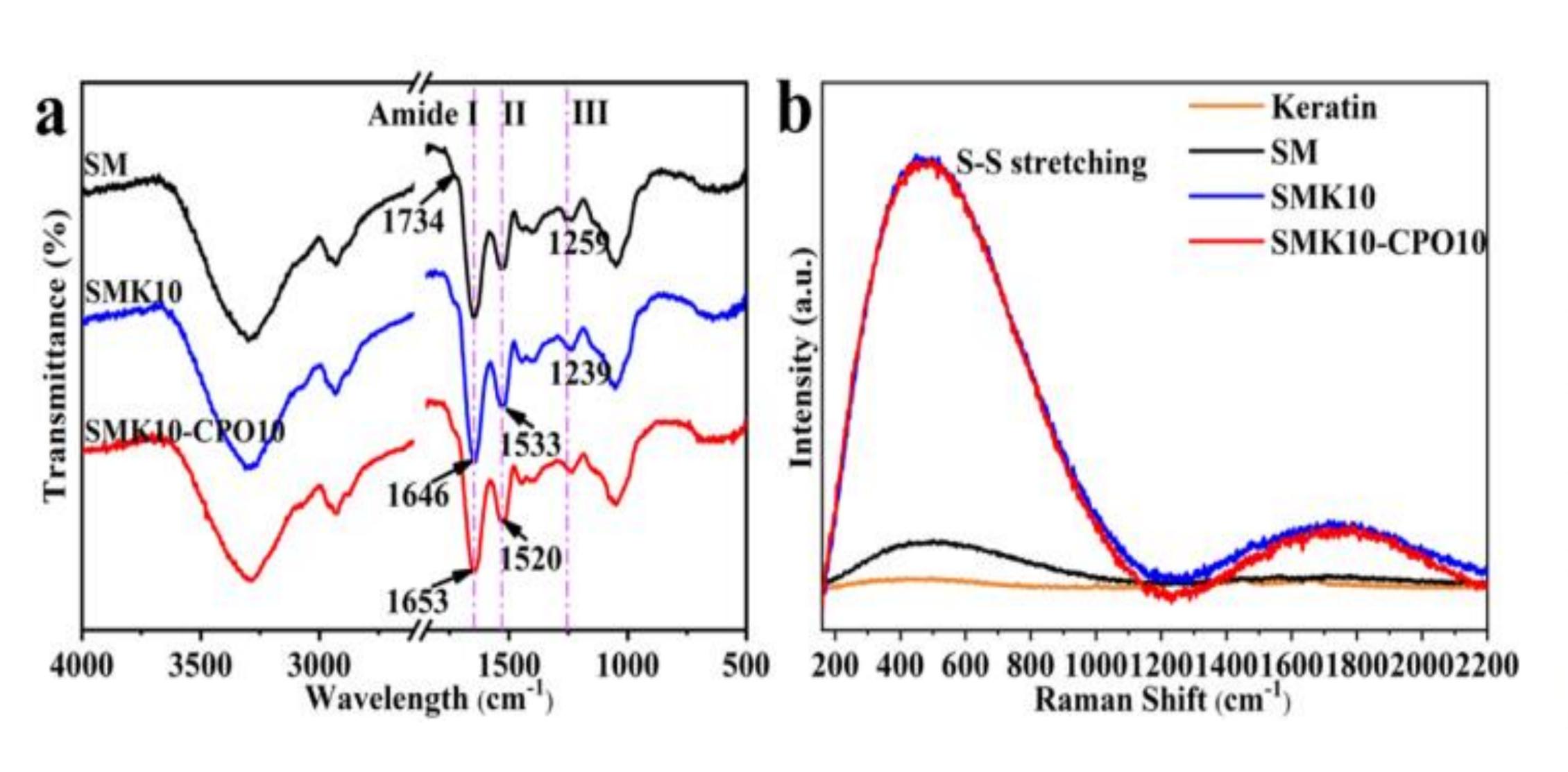
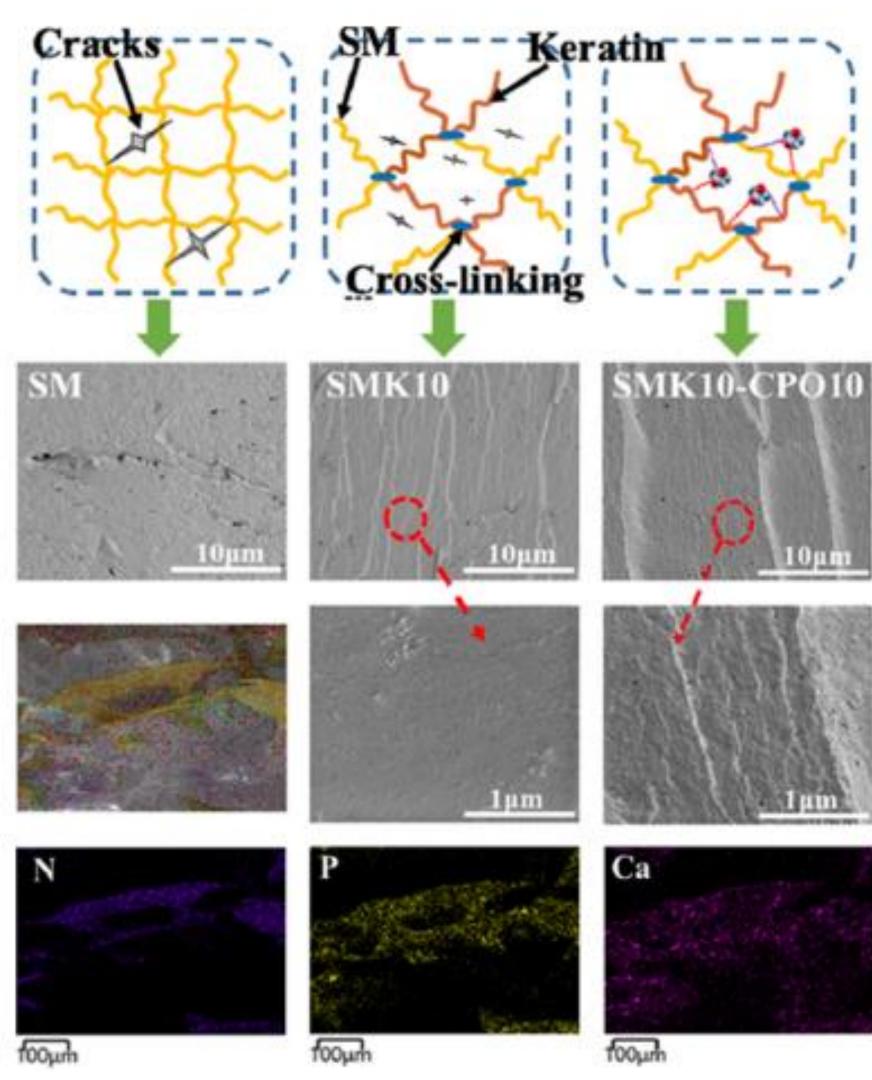


Table 2. Temperature of the Maximum Degradation Rate and Residue Weight Fraction for Different Cured Adhesive Samples

samples	T <sub>10%</sub> (°C)	$T_{30\%}^{a}$ (°C)	$T_{50\%}^{a}$ (°C)	$T_{\text{max}}^{b} (^{\circ}\text{C})$	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