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Sustainable triblock copolymers as strong, tunable, and degradable pressure sensitive adhesives

A method to produce strong, tunable, and degradable pressure sensitive adhesives from by-products of the cashew industry.

IP Status: Provisional Patent Application Filed; **Application #:** 63/006,470

Applications

- Removable or permanent pressure sensitive adhesives
- Heat-activated adhesives for medical devices
- Bio-based materials
- Adhesives for repulpable/recyclable tapes

Pressure sensitive adhesives: Problems - Solutions

Pressure sensitive adhesives (PSAs) are widely used in many applications such as sticky notes, labels, tape, and stamps due to their facile adhesion to substrates with a minimal applied force. Most commercial pressure sensitive adhesive (PSA) materials are derived from fossil resources which are not sustainable. These materials are often poorly degradable and result in "residual adhesive" problems during the paper recycling process in pulping facilities.

To address these issues, researchers at the University of Minnesota have developed a new method to prepare novel PSA materials from renewable resources with high bio-based contents (>90%). Specifically, a series of ABA triblock copolymers were designed and successfully synthesized with corn-derived poly(lactide) (PLA) as the glassy end blocks and poly(pentadecyl caprolactone) (PPDCL) containing a long alkyl (C15) substituent as the rubbery B-central block. This PPDCL is a new aliphatic polyester that was synthesized from cashewnut-shell-liquid-derived lactones in a controlled and tunable fashion. The new PSA material exhibits adhesion properties competitive with commercial adhesives (such as duct tape) with the added benefit of renewable bio-based contents and hydrolytic degradability.

Key Benefits & Differentiators

- **Sustainable and scalable precursor:** Pentadecyl caprolactone monomer is synthesized from cashew nut shell liquids, which are inexpensive, abundant, and easily extractable by-products of the cashew industry.
- **Competitive adhesion properties:**
  - **Strong:** Maximum peel strength =10.2 N/cm; loop tack = 11.0 N/cm (respective of 180° peel and loop tack strength).
  - **Tunable:**The adhesion properties can be largely tuned from sticky note level to permanent adhesive level (i.e., stronger than duct-tape) by simply changing the polymer/tackifier ratio.
  - **Heat-activated:** Peel adhesion is thermo-responsive, potentially in the range relevant to medical device applications.
  - **Hydrolytic degradability:** The new PSA material is degradable by acid-catalyzed hydrolysis.

Technology ID
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Category
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Phase of Development

Proof of concept. Materials were synthesized and experimentally characterized at lab scale.

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Publications

Sustainable triblock copolymers as tunable and degradable pressure sensitive adhesives
ACS Sustainable Chem. Eng.

Ready for Licensing
This technology is now available for license! The University is excited to partner with industry to see this innovation reach its potential. Please contact us to share your business' needs and your licensing interests in this technology. The license is for the sale, manufacture or use of products claimed by the patents.