Eutectogel 2.0: A Continuous Journey Towards Advanced Green Electronic Skin

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The rapidly growing field of electronic skin faces a critical challenge: the development of interface materials that are conductive, soft, and compatible with human skin to effectively monitor body activity. Traditional materials such as hydrogels and ionogels face several challenges including dehydration in open air, poor temperature stability, rigidity, and discomfort. My project introduces a transformative solution: a eutectogel-based electronic skin that is sustainable and easily synthesized. Eutectogels are an innovative material formed by the polymerization of a deep eutectic solvent (DES) consisting of hydrogen bond donors (HBD) and acceptors (HBA) mostly derived from naturally occurring compounds. Following my research last year in improving the mechanical properties of the gel through the addition of cellulose fibers, I identified a lack of conductivity and the need to validate biocompatibility as major areas for improvement. My unique contribution is the development of a highly conductive eutectogel composite through the addition of PEDOT:PSS. This addition enhances the electrical properties of the gel while maintaining excellent elasticity and deformation recovery. Through extensive screening, I identified an optimal composition and preparation process for a eutectogel consisting of DES components and PEDOT:PSS to achieve >100 times improvement in conductivity and >2.5 times increase in elongation at break. Biocompatibility testing validated the low cytotoxicity of the material. These enhancements enable this e-skin material to effectively capture and transmit biopotential signals such as brain activity, advancing analysis and supporting the restoration of functional abilities for patients with disabilities (neurological, muscular, etc.).

Awards Won: