Bio-Compatible Solid Polymer Electrolytes from Natural Silk and PVA for Sustainable Energy Storage applications

The growing demand for sustainable and environmentally friendly energy storage technologies necessitates the exploration of bio-based materials in battery components. This proposal aims to develop a green, cost-effective solid polymer electrolyte (SPE) by blending silk cocoon powder—a natural protein-rich material—with polyvinyl alcohol (PVA), a water-soluble polymer known for its film-forming ability. The incorporation of ammonium nitrate as a proton donor and glycerol as a plasticizer is expected to enhance the ionic conductivity and mechanical flexibility of the electrolyte. The use of silk cocoon powder, rich in sericin and fibroin, introduces functional groups conducive to proton conduction, while contributing to biodegradability and resource circularity. The proposed research will focus on optimizing the composition, casting method, and electrochemical performance of the SPE films. Structural and conductivity analyses using FTIR, XRD, and EIS will be conducted to evaluate the material's suitability for green battery applications. The expected outcome is a bio-compatible, non-toxic, and efficient solid polymer electrolyte that can serve as a viable component in next-generation energy storage systems.