

Title: Engineering biodegradable controlled gelatin-zein bilayer film with improved mechanical strength and flexibility

Author Names: Md Easdani , Shabbir Ahammed , Md Nazmus Saqib , Fei Liu , Fang Zhong

Abstract: Compiling hydrophobic and hydrophilic proteins to form mechanically reliable bilayer film with improved water barrier properties and hydrophobicity to replace petroleum-based standards is challenging because fabricating compatible surfaces and flexible film with interlinked interfaces is complex. The mechanical properties of gelatin and [zein](#) layers exhibited unique variations, and synergistic enhancement of bilayer properties reflected robust layer-by-layer (LBL) interactions. To overcome the problem of impaired integrated surface, viscously cross-linked [zein](#) film forming solution (FFS) by glyoxal (GX) introduced compact and closely entangled network formation with cross-linking of gelatin film. Zein surface compatibility and flexibility by GX and [polyethylene glycol](#) (PEG 400) synergized with the gelatin layer closed to compare flexible plastic materials such as PE and [PP](#) besides modulated color and transparency. Enhancing flexible formation was mechanized by acetic acid as solvent of zein solution after long-range repulsion during casting on well-manageable plasticized and cross-linked gelatin film with glutaraldehyde (GA) and PEG 400, respectively. Elongation (E%) was achieved by nearly 192% with modified tensile strength (TS) and Young's modulus (YM). Cross-linkers, especially GX, resulted in lower water solubility (WS), and joint layers resulted in controlled water vapor permeability (WVP) of bilayer films. Decreased surface roughness and WS increased water contact angle (WCA). [FTIR spectroscopy](#), [XRD](#) analysis, DMTA, and SDS-PAGE analyzed cross-linking mode and intensity. Hence, gelatin-zein bilayer films showed significant potential for improving value-added functional properties.

Key words: Gelatin-zein bilayer film; Hydrophobic and hydrophilic proteins; Layer-by-layer (LBL) interactions; Mechanical properties;

<https://doi.org/10.1016/j.foodhyd.2023.109430>

<https://www.sciencedirect.com/science/article/abs/pii/S0268005X23009761>