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Influence of plasticizers on the mechanical and barrier properties of cast biopolymer films

V. Jost^{1,2}, C. Stramm¹

¹Fraunhofer Institute for Process Engineering and Packaging IVW, Freising, Germany

²Chair of Food Packaging Technology, Technische Universität München, Freising, Germany

Abstract:

The potential of biopolymers for packaging application is often limited due to their poor processability. In this study, the effect of commonly used plasticizers on the properties of different cast biopolymer films is investigated. This enables a valuation of the potential of different biopolymers as packaging materials and an estimation of the effectiveness of plasticizers for certain biopolymer systems. Polysaccharides (corn starch and alginate) and plant proteins (wheat gluten and pea protein) were tested as film materials. To improve the processability by decreasing the brittleness of these cast biopolymer films, glycerol (Gly), sorbitol (Sor), and triethanolamine (TEA) were added as plasticizers. The structural, mechanical and barrier properties to water vapour and oxygen were characterized in order to study the effectiveness of the plasticizers and their respective influence on the film properties. The mechanical results show there was a plasticizing effect with all the plasticizers, but the influence on the barrier properties depends on the specific plasticizer: While glycerol (Gly) leads to an increase in water vapour and oxygen permeability (OP), Sor leads to almost constant, and TEA even to decreased OP of the biopolymer films. Therefore, careful selection of the plasticizer allows biopolymer films with improved processability and high or low permeabilities to be manufactured.

Keywords: biopolymers, renewable polymers, coatings, mechanical properties, packaging, plasticizer