



A statistical analysis of interaction between crystallinity and elongation in plasticized biopolymer

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Abstract

Biopolymer such as amylose starch, when mixed with plasticizers has excellent potential in forming thin film for various food and packaging applications. In this study, the influences of moisture content, plasticizer type and content have been investigated on the tensile elongation and crystallinity of starch biopolymeric material. Biopolymeric samples prepared with starch (LA) and two types of plasticiser with different molecular weights, namely glycerol (GLA, Mwt-92) and xylitol (XLA, Mwt-152), were employed, which also have different number of hydroxyl (OH) groups (3 for glycerol and 5 for xylitol). A statistical analysis based on a design of experiment (DoE) was performed on the sample responses (i.e. elongation and crystallinity) by varying the moisture content, plasticizer type as well as plasticizer content.

Key words: *Thin films, Starch, Biopolymers, Plasticizer, Tensile elongation, Crystallinity*

1. Introduction

Amylose or amylopectin when introduced into starch as semi-crystalline granules has high sensitivity to relative humidity (RH) and thus is difficult to make flexible films at ambient temperature due to its hydrophilic nature (Myllarinen *et al.*, 2002) and high glass transition temperature (T_g). This drawback could be overcome by using plasticizers to reduce the influence of RH while enhance the flexibility of the matrix (Gaudin *et al.*, 1999; Cheng *et al.*, 2006). However, the complexity

of interactions between the hydrophilic plasticizers and the starch motivates the study of this work to understand the relationship between the development of a particular morphology due to starch-plasticizer-water interaction and the macroscopic polymer structure. A supplementary design of experiments analysis was reported for the first time to explicitly interpret the complex hydrophilic interaction within the plasticized starch biopolymeric system.

2. Experimental

2.1. Materials and testing procedures