Blown-extrusion of biodegradable active packaging with food preservatives: Packaging properties, food quality and safety

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Abstract

This research aimed to develop biodegradable films from polymer blended film containg food preservatives. ^{1}H-NMR and FTIR showed that the added preservativesmodified the chemical structure, leading to modified film properties. Accordingly, these food preservatives effectively enhanced functionality of films and maintained quality and safety, thus improving food quality and safety.

Introduction

Petroleum-based non-biodegradable plastic packaging is a major cause for the environmental impact. The environmental impact of food packaging has driven the development of bioplastic packaging. Biodegradable plastic or bioplastic is a major factor for driving the global economy. The bioplastic packaging has been developed to improve the properties by incorporating additive compound, composite polymer and polymer blends. The compatibility between polymers is necessary to improve the properties of final product and enhance interfacial adhesion of polymer blend, giving homogenous structure, strong mechanical properties, high barrier and thermal resistance [1].

Quality and shelf life of foods are important parameters affecting consumer perception and safety. The addition of food preservatives directly to the product influence consumers health and perception, which is a major problem, because consumers primarily concern the safety and health. The amount of food preservative residual in the product is the major point. So, the development of food packaging considered quality and safety as primary factors [2]. Consequently, the development of bio-based food packaging needs to consider interaction between food and environment because packaging affects the food sensory properties and consumer's safety.

Objectives

- To develop biodegradable active packaging to retain quality of meat products using extrusion process
- To evaluate interactions and migration between bioplastic packaging and food preservatives using ^{1}H NMR, FTIR and HS-SPME-GC-MS technique.

Materials and methods

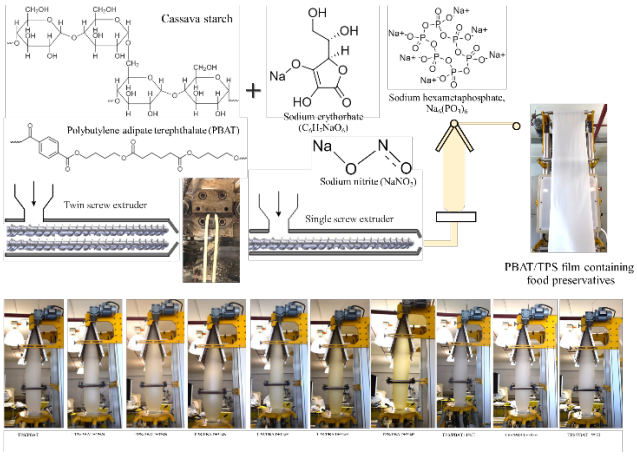

Figure 1 Flowchart of TPS/PBAT films containing nitrite (N), erythorbate (E) and hexametaphosphate (H) at difference ratios (1, 3 and 5%) via blown-film extrusion.

Results

The morphology, phase transition behavior, mechanical strength and barrier properties of active packaging were determined. The results (Figure 2) showed that hexametaphosphate gave tighter film structure than erythorbate due to better melting and granule disruption of starch. Food preservatives decreased mechanical relaxation temperature.

Topographic images indicated surface roughness of the films, while erythorbate gave smoother surface than hexametaphosphate probably due to smaller molecular size. Interaction between TPS/PBAT and food preservatives modified mechanical strength, involving H-bonding and carbonyl group and modified barrier properties [3]. The active films were applied for fresh beef packaging. Film containing food preservatives effectively retained quality, while preserved redness, reduced metmyoglobin formation and maintained lipid oxidation during storage.

The migration of TPS/PBAT biodegradable films containing food preservatives as a fresh meat packaging were studied in 95% ethanol, 10% ethanol and 3% acetic acid as food simulants using HS-SPME-GC-MS technique [4]. The risk assessment was applied and it was found that three volatile compounds namely 1,6 Dioxacyclododecane-7,12-dione, glycerin and eicosane after migration with 95 % ethanol. For 3% acetic acid one compound was found namely penranoic acid, 2, 2, 4-trimethyl-3-carboxyiopropyl, isobutyl ester, while in 10% ethanol any volatile was detected after migration

Conclusions

Incorporation of food preservative into the packaging has potential to modify the compatibility between biodegradable polymer blend, enhanced functional properties to maintain quality of meat products and safety of food packaging, which effectively produced sustainable packaging.

References

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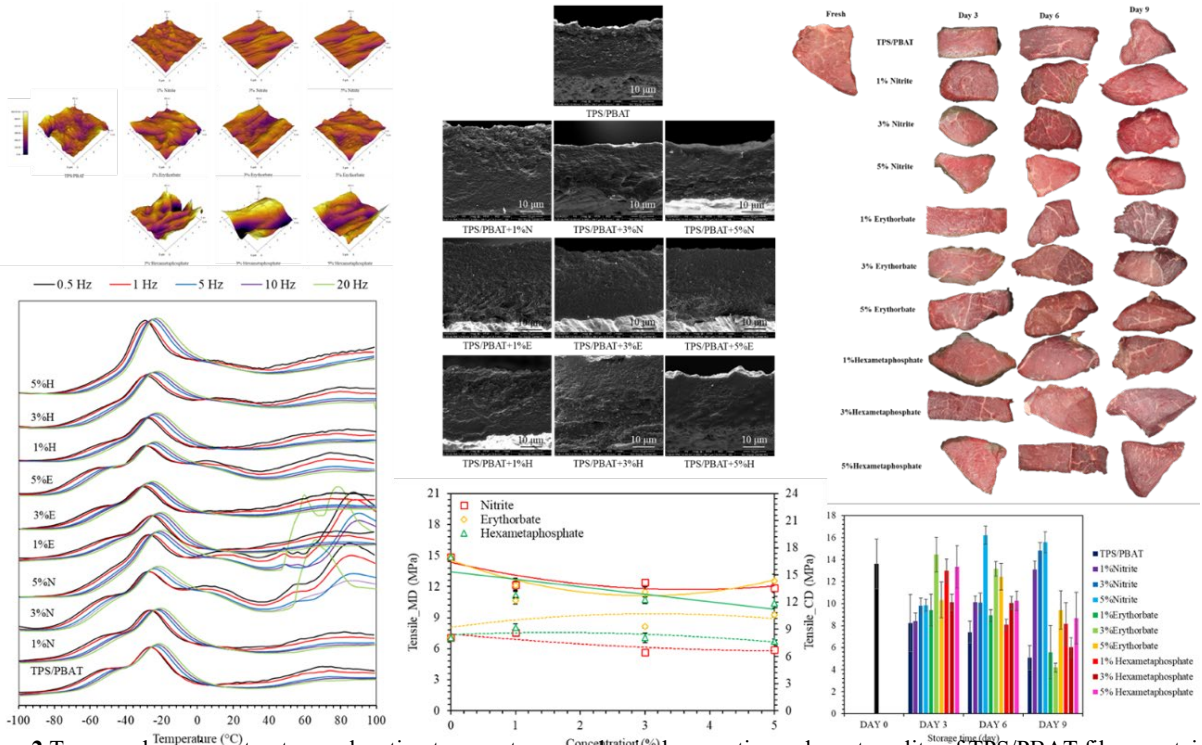

Figure 2 Topography, microstructure, relaxation temperature, mechanical properties and meat quality of TPS/PBAT films containing nitrite (N), erythorbate (E) and hexametaphosphate (H) at difference ratios (1, 3 and 5%) via blown-film extrusion.