ANTIOXIDANT EDIBLE FILMS BASED ON BACTERIAL CELLULOSE AND TILAPIA GELATIN SKIN PEPTIDES

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ABSTRACT

In this work antioxidant films (AF) based on bacterial cellulose nanofibers (BCNF) and fish skin gelatin peptides (AFSGP) were developed. AFSGP addiction up to ~44% contributes to increase antioxidant activity (Aa) of BCNF films. The films containing AFSGP and sorbitol presented similar opacity compared to BCNF films without AFSGP. Considering the compact nanostructure, Aa, water vapour permeability and thermal stability, BCNF/AFSGP films can be used as bioactive food packing.

INTRODUCTION

Bacterial cellulose (BC) is a nanostructured natural polymer with desirable characteristics for food applications. Currently, BC was included in food innovative approaches as bioactive coating and packaging (BCP) technologies. Chemical and mechanical treatments were studied to develop cellulose nanofibers suspensions that contribute significantly to high-performance materials and resistant packaging. Stable BCNF suspensions are a more dynamic material than native BC membranes and can be used as filmogenic coatings. BCPs have been used to increase the shelf life and quality of food products through controlled release of bioactive compounds on food surface. Generally, incorporation of natural chemical agents as antioxidant peptides are preferred than synthetic chemicals, since the first are ease of acceptance by the consumer and do not elicit health safety issues. Few studies investigated BCPs based on peptide/BC composite and cellulose nanofibers form dense and strong films (Rodionova, 2012). This work aimed to evaluate thermal, morphological, mechanical, water barrier, and optic properties of antioxidant films based on BC nanofibers and tilapia skin gelatin peptides.

BC produced in static culture by Gluconacetobacter hansenii ATCC 53582 in HS medium was purified by alkali treatment and oxidized following Saito (2006) method. BCNF 1% was obtained by mechanical treatment of TEMPO-oxidized BC (BCOX) in high-speed blender (VITAMIX® 5200). AFSGP solution was obtained by enzymatic hydrolysis of tilapia skin gelatin with Alcalase. Antioxidant films (AFs) were obtained by mixture of BCNF suspension and different amounts of AFSGP with posterior drying at 50°C. Sorbitol or glycerol was used as plasticizer in P5 film. Antioxidant activity (Aa) was determined by DPPH method adapted for films and values expressed in % per miligram of film. Some formulations were characterized by Thermogravimetric Analysis (TGA), Tensile Tests, Transmission and Scanning electron microscopy (SEM and TEM), Water vapour permeability (WVP), Water solubility (WS) and Opacity.

RESULTS AND CONCLUSIONS

Mechanical treatment of TEMPO-oxidized BC in high-speed blender was effective to create a stable aqueous suspension with reduced nanofiber width (33 ± 9 nm) when compared to the nanofiber width from native BC (77 ± 2 nm). Moreover, films formulated with BCNF presented the same thermal stability, lower opacity and high compactness than the native BC pellicle. All films formulated by addiction of different amount of AFSGP exhibit Aa (Fig.1), even when peptides were added in low amounts as P0.1 film. Maximum Aa was observed in the formulation containing ~44% of AFSGP (Fig. 1). When sorbitol was added in P5 film, Aa increased from 2.0 to 2.6%/mg of film. In higher percentages of AFSGP (P15 and P10 films) Aa decreased. P5/Sorbitol film exhibit 1.6 g.mm/kPa.h.m^2 of WVP, ~0.6 GPa of Young's modulus and Tonset of 110°C. These characteristics indicate BCNF/AFSGP films as adequate for production of food packing.

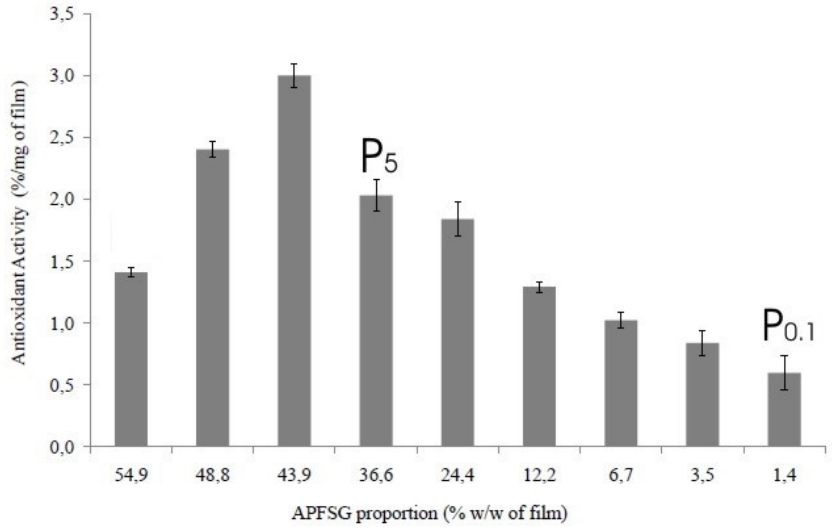

Fig.1 Antioxidant Activity of BCNF/APFSG films.

The antioxidant films developed in this work exhibited potential to be used as bioactive edible coating to increase the shelf life of meat products.

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