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Shelf Life Extension of Toasted Groundnuts through the Application of Cassava Starch and Soy Protein-Based Edible Coating

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ABSTRACT

The use of cassava starch and soy protein concentrate edible coatings containing 20% glycerol in extending the shelf life of toasted groundnut during ambient (27 ± 1°C) storage for 14 days was studied. Chemical indices of oxidative rancidity and sensory parameters were evaluated using standard procedures. Moisture uptake, peroxide and thiobarbituric acid values of uncoated groundnuts were higher than 100% cassava starch coated groundnuts while toasted groundnuts coated with 50:50 (cassava starch:soy protein concentrate) had the lowest values. Toasted groundnuts coated with 50:50 (Cassava starch:soy protein concentrate) film had higher colour, taste, texture and overall acceptability scores than toasted groundnuts coated with 100% cassava starch film and control. The use of 50:50 (cassava starch:soy protein concentrate) edible coatings on toasted groundnut extended the shelf life of toasted groundnuts for 14 days compared to uncoated toasted groundnuts which developed objectionable taste after second day of storage at ambient (27 ± 1°C) condition.

Keywords: Cassava starch, soy protein concentrate, edible film, toasted groundnuts, shelf life extension.

Introduction

Toasted groundnut is a widely consumed form of groundnut in Nigeria, which can be consumed alone or combined with dry toasted maize (pop-corn), 'garri', coconut, bread or plantain (Bankole *et al.,* 2005). Toasted groundnuts like other forms of groundnuts are rich in protein, fat, minerals and vitamins, and have crispy texture and nutty flavour. Nuts are prone to the development of oxidative off-flavour because of their high polyunsaturated lipid content (Yazdani *et al.,* 2006).

According to Riveros *et al.* (2013), synthetic antioxidants such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT) and propyl gallate (PG), are used in many foods to prevent rancidity, and their health safety remains questionable. Also, the antioxidant effect of natural antioxidants such as essential oils are not enough in many cases in decreasing deterioration and shelf life extension of nuts (Olmedo *et al.,* 2008; Silva *et al.,* 2010; Riveros *et al.,* 2013). On the other hand, synthetic polymers used as food packages tend to react with food materials releasing naptha-based compounds which may be carcinogenic on ingestion by humans (Parra *et al.* 2004) and contribute to environmental pollution (Arvanitoyannis *et al.,*1996; Krochta and De Mulder-Johnston, 1997).

Edible films and coatings are innovations within biodegradable active packaging concept, which can improve safety and/or functional or sensory

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properties while maintaining the quality of food packaging (Parra *et al.,* 2004; Riveros *et al.,* 2013). Cassava starch coatings have been applied in fruits such as mango and pineapple in order to extend their shelf while preserving quality (Chiumarelli *et al.,* 2010; Bierhals *et al.,* 2011). To date, there is paucity of information on the use of coatings prepared from blends of cassava starch and soy protein concentrate in preserving the quality of textured foods such as toasted groundnuts.

Edible films have been successfully produced using cassava starch and soybean protein concentrates (Chinma *et al.,* 2012). In that study, results obtained showed that addition of up to 20% glycerol level improved the sensory, mechanical and water vapour permeability properties of cassava starch-soy protein concentrate edible films compared to 100% cassava edible film. Also, the results indicated that 50:50 cassava starch:soy protein edible films have improved mechanical and low water vapour permeability value and could therefore find application as coatings in textured foods. This forms the thrust of this study on the use of cassava starch-soy protein concentrate edible coatings in preserving the quality attributes of toasted groundnuts.

Materials and Methods

Source of raw material

Fresh sweet cassava (TMS 30470) tubers and soybean (TGX 1448-2E) seeds were procured from Crop Production Department, Federal University of Technology, Minna, Nigeria.

Cassava starch extraction, preparation of soy protein concentrate and edible coatings

Cassava starch extraction and soy protein concentrate were prepared as reported by Chinma *et al.* (2012).

Film forming solutions were prepared from cassava starch and soy protein concentrate (100:0 and 50:50) containing 20% glycerol as described by Chinma *et al.,* (2012). Glycerol concentration of 20% was weighed and dissolved into distilled water, followed by the addition of composite blends to obtain film forming suspension in which starch concentration was 5% (w/w) of overall water content independent of plasticizer concentration. The pH of the film forming suspension was adjusted to 9.98 (with 1 M NaOH) using a pH meter (DELTA 320). The film forming suspension was heated in a heating flask in a hot plate over 90°C for 5 min with continuous stirring using a glass rod to obtain the film forming solution.

Coating of toasted groundnuts

Dipping method as described by Chien *et al.* (2007) was adopted for coating of toasted groundnut. Toasted groundnuts were dipped into film forming solution for about 15 sec. The coated samples were taken out from the solution with a slotted spoon and then put on an aluminum foil to allow excess coating material to drain from the product. Coated samples were allowed to dry under fan for 1 min. The samples were treated by dipping 3 times to ensure a uniformity of coating on the surfaces. Coated and un-coated toasted groundnuts were stored at ambient condition (27±1 °C) for 14 days. They were analyzed for chemical and sensory properties at intervals of 2 days.

Performance evaluation of edible coatings

The moisture content and peroxide value of coated and uncoated toasted groundnuts were determined according to the method described by AOAC (1995) while thiobarbituric acid value was determined as described by Pearson (1981).

Sensory evaluation

A twenty-member trained panel was used for sensory evaluation of coated and uncoated toasted groundnuts. Sensory evaluation was carried out for two weeks at intervals of two days. The coded samples were randomly presented to sensory panel in white plastic plates. Coated and uncoated toasted groundnuts were evaluated for colour, taste, texture and overall acceptability while fresh toasted groundnuts were used as standard. Each sensory attribute was rated on a 9-point hedonic scale (where 1 = disliked extremely while 9 = liked extremely).