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Extension shelf life of batte by using hydrocolloids and gamma irradiation

Mervat M. Anwar [a,*], M.A. Asael [b], E.H. Nasr [a]

[a] Plant Research Department, Nuclear Research Center, Atomic Energy Authority, P. No. 13759, Cairo, Egypt
[b] Bread and Pastries Research Department, Food Technology Research Institute, Agricultural Research Center, Giza, Egypt

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ABSTRACT

Batte (is baked french) one of the most baked coated most prevalent in the markets after the cake wrapping. Batte exposed generally two types of corruption which is occurring phenomenon of (anti-staling) and corruption microbial (molds). In this study produced batte with an attempt to prolong the period of its validity by addition 1.5% hydrocolloids, (which is 0.5% sodium alginate, 0.5% k-carrageenan and 0.5% hydroxyl propyl methylcellulose) (HPMC) to hard wheat flour 72% (HWF) to improve materials for mellowness and anti-staling, whereas batte exposed to gamma irradiation at doses 0.5, 1, 1.5, 2, 3 and 5 kGy to decrease microbial load. Hydrocolloids at 1.5% improved the rheological properties of dough farinogragh and aextensograph parameters. The hydrocolloids increase flexibility, rubber and freshness of batte to 24 days compared to 8 days in control sample. Thiobarbituric acid (T.B.A) values at the end of storage at room temperature (ranged to 0.253 –0.352 mg malonaldehyde/kg) that were less than these mentioned by the Egyptian Standard. Also, gamma irradiation reduced the total bacterial count of batte product. Sensory evaluation of produced batte was done. The addition of 1.5% hydrocolloids and exposed to gamma irradiation had higher freshness and increase shelf-life for 20, 25, 30, 35 and 40 days against only 15 days for control sample.

1. Introduction

Nowadays, the use of additives has become a common practice in the baking industry. Compounds hydrocolloids for bakery applications are described hydrocolloids are widely used as additives in the food industry, because they are useful for modifying the rheology and texture of aqueous suspensions (Dziezak, 1991). Hydrocolloids due to their high water retention capacity confer stability to the products that undergo successive freeze–thaw cycles (Lee, Baek, Cha, Park, & Lim, 2002). They have also shown good properties as fat mimetic in different products (Albert & Mittal, 2002; Lucca & Tepper, 1994).

Hydrocolloids are water-soluble, high molecular weight polysaccharides that serve a variety of functions in food systems, such as enhancing viscosity, creating gel-structures, formation of a film, control of crystallization, inhibition of syneresis, improving texture, encapsulation of flavors and lengthening the physical stability, etc. (Dickinson, 2003; Dziezak, 1991; Garti & Reichman, 1993; Glicksman, 1991).

* Corresponding author. Tel.: +20 1065780603.
E-mail address: mervat_mohamedanwar@yahoo.com (M.M. Anwar).
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These functional ingredients are widely used in dairy products, canned foods, bakery products, salad dressings, beverages, sauces, soups and other processed foodstuffs to improve textural characteristics, flavor and shelf life. Several authors have reviewed various applications of food hydrocolloids in the food industry (Anderson & Andon, 1988; Niederauer, 1998). Polymers with a wide range of functional properties can be created in a reaction where hydroxyl groups are substituted with different side chains such as methyl, hydroxyl propyl, carboxy methyl groups. Addition of hydrophobic groups to hydrophilic polymer, or Vice versa, leads to a polymer with a high surface activity. One of the well known emulsifying hydrocolloid is hydroxyl propyl methylcellulose (HPMC) which is used in bread making due to its ability to retard the staling and improve the quality of the fresh products.

Several studies have been carried out showing the potential use of hydrocolloids in the baking industry. In addition, an improvement in wheat dough stability during proofing can be obtained by the addition of hydrocolloids, namely sodium alginate, k-carrageenan, xanthan gum and hydroxyl propyl methylcellulose (HPMC) (Rosell, Rojas, & Benedito, 2001). Later, (Collar, Martinez, & Rosell, 2001) studied the effect of CMC and HPMC addition on dough and bread performance of formulated wheat breads and their interaction with α-amylase and emulsifiers. It has also been proposed the use of xanthan in frozen dough to increase its stability during freeze–thaw cycles (Dziezak, 1991). From above, it is evident the wide use of hydrocolloids in bread making, nevertheless the properties of the hydrocolloids vary in a great extent depending on their origin and chemical structure (Rojas, Rosell, & Benedito, 1999). For instance CMC has a preferred interaction to gluten while HPMC shows preferential binding to starch (Collar et al., 2001). In addition, pasting properties of wheat starch are largely modified by hydrocolloids addition, although the extent of their effect depends upon the chemical structure; xanthan and pectin increase the cooking stability while k carrageenan mainly affect the bump area related to the formation of amylose–lipid complex (Rojas et al., 1999).

Application of hydrocolloids as bread improvers has been extensively investigated in recent years (Guarda, Rosell, Benedito, & Galotto, 2004, Kohajdová, Karovi_cová, & Schmidt, 2009). Although natural hydrocolloids have unique functional properties, they are also characterized with certain limitations such as water insolubility, in stability at low pH, etc. which restrict their overall utilization (Milani & Maleki, 2012).

Gamma irradiation improve the safety, efficiency, is suitable for disinfestation, microorganism load reduction or sterilization, increase the shelf life of food. Food irradiation has been approved by several authorities (FDA, USDA, WHO, FAO, etc.) and scientific societies based on extensive research (Morehouse, 2002; Tritsch, 2000). Ionizing radiations do not cause any significant rise in temperature and the flavor, texture or other important technological or sensory properties of most ingredients are not influenced at low radiation doses (Farkas, 2006). Irradiation as a decontamination method used for a many variety of foodstuffs, being very feasible, useful method to increase the shelf life, effective and environmental friendly without any sensory properties significant change (Rodrigues, Fanaro, Duarte, Koike, and Villavicencio, 2012).

The aim of the present study is to examine the effect of addition 1.5% hydrocolloids which is 0.5% sodium alginate, 0.5% k-carrageenan and 0.5% hydroxyl propyl methylcellulose (HPMC) to hard wheat flour 72% (HWF) to improve materials for mellowness and potential use in retarding the staling process during storage at room temperature and improve the rheological properties of dough, also increase freshness values (%) of produced batte. In study the addition effects of different doses of gamma radiation at (0.5, 0.1, 1.5, 2, 3 and 5 kGy) on chemical composition and thiobarbituric acid (TBA) values of batte, also extension the shelf life of batte by reduction total bacterial counts, molds and yeasts counts and evaluation sensory properties of batte during storage periods at room temperature.

2. Materials and methods

2.1. *Materials*

Commercial Hard wheat flour (72% ext.), containing 13.2% protein (moisture content, 14%),0.7 fats,0.56 fiber and 0.61% ash was obtained from Modern Flour Mills &Macaroni Company, Amman, Jordan. Hydrocolloids include hydroxyl propyl methylcellulose, sodium alginate and k-carrageenan were obtained from Nore Industrial and Laboratory Chemicals, Giza, Egypt. Dried yeast, crystal white sugar, salt (sodium chloride) and fats were purchased from the local market, Cairo, Egypt.

2.2. *Methods*

Determination of proximate analysis (moisture content, protein, fat, crude fiber and ash content) were determined according to A.O.A.C (2010). Total carbohydrates were calculated by difference according to the Egan, Kirk, and Sawyer (1981). Thiobarbituric acid (TBA) values was determined according to the methods of Pearson (1991).

The effect of different hydrocolloids on dough mixing properties was determined by a Brabende farinograph (Duisburg, Germany) following (DDT), and stability. Extensograph test was carried out on wheat flour (72% extraction) to determined the maximum resistance to extension, elasticity, proportional number and energy according to the method described in the A.A.C.C (2008).

The staling of batte bread loaves were tested by alkaline water retention capacity (AWRC) determination according to the method of Kitterman and Rubemthaler (1971).

Total bacterial count was determined in samples of batte according to pour colony count method using plate count agar medium as recommended by the APHA (1992).

Total molds and yeasts were counted on oxytetracycline glucose yeast extract agar medium according to the method of Oxoid (1982).

2.2.1. *Batte pastry process*

Dough were preparation according to the method described by Sternhagen and Hoseney (1994). The produced batte were