THE USE OF EDIBLE FILMS AND COATINGS TO PRESERVE MEAT QUALITY

Miriam N. Martino

Centro de Investigación y Desarrollo en Criotecnología de Alimentos, CIDCA. Fac. de Ing., UNLP. 47 y 116. La Plata (1900). Argentina

Edible films and coatings from polysaccharides, proteins and/or lipids can be used to preserve food quality. They act as a barrier to gas, aroma, water vapor and solute migration between the food and the environment. Edible barriers produced from renewable resources are environment-friendly without the negative effects of traditional packaging materials. The use of edible films and coatings has been widely studied to prolong the shelf life of fruits and vegetables (Krochta and De Mulder-Jonston, 1997; García et al., 2000). Several types of coatings and films have been tested in an attempt to maintain the quality of fresh and frozen meat, poultry and seafood products. The main problems associated to the degradation of these products are moisture loss, lipid oxidation, protein alterations which lead to changes in water binding capacity, texture, aroma, flavor and color changes. Besides, precooked meat products are susceptible to lipid oxidation during refrigerated storage, which leads to the development of rancid or stale flavor, denoted as warmed-over flavor (WOF). Nevertheless, the application on precooked meat products has not been so extensively used (Gennadios et al., 1997). The potential benefits of using edible coatings on meat products include: a) reduction of moisture loss with an significant economical impact, b) by preventing exudate production coatings enhance product presentation and eliminate the need of absorbent pads at the bottom of the trays, c) reduction of lipid and myoglobin oxidation by using edible coatings with low oxygen permeability, d) reduction of volatile flavor loss and foreign odor pick-up by meats, e) the use of active coatings as carriers of antioxidants (e.g. tocopherols), antimicrobials (e.g. organic acids) can delay rancidity and discoloration and reduce microbial counts, f) coatings can reduce oil uptake during frying of battered or breaded products. Also, some biopolymers from byproducts of the meat, poultry and fishery industries like gelatin, blood protein, feather keratin, fish myofibrillar protein and chitosan from crustacean shells can by used as film and coating materials.

A number of polysaccharide coatings have been used to improve stored meat quality, including alginates, carrageneans, cellulose ethers, pectin and starch derivatives. Most of them offer little barrier against moisture transport. However, moisture contained within gel-type coatings serve as sacrificing agent delaying the loss of product moisture. Use of alginate coating gelled with calcium chloride, alone or combined with starch derivatives reduced shrinkage, drip, off-odor of uncooked and cooked products and improved texture, juiciness and color in same cases. However, the amount of calcium chloride addition should be balanced between its gelling action and the resultant bitter taste. Thermal gelation of methylcellulose and hydroxypropyl methylcellulose solutions has been used to produce glazed sauces to minimize runoff during seafood and poultry cooking and to reduce moisture loss during deep-fat frying while decreasing oil absorption (Gennadios et al., 1997).

Animal and plant proteins like collagen, gelatin, milk proteins, wheat gluten, corn zein, soy and peanut proteins are usually combined with plasticizers such as glycerol or sorbitol to obtain edible coatings. Similarly to polysaccharides protein coatings have relatively high water vapor permeability due to their hydrophilicity, and good oxygen barrier properties in low relative humidity environments. However, protein coatings may be associated to certain problems such as protein susceptibility to proteolytic enzymes present on raw meats and the potential occurrence of adverse reactions on certain individuals (e.g. allergies, celiac disease, lactose intolerance). Sausage casings are commonly made of collagen either by batch or co-extrusion processes; other protein like wheat gluten, corn zein, feather keratin, soy and peanut proteins can be used as well. Corn zein films containing an antioxidant and other additives used to wrap cooked turkey breast slices reduced warmed-over flavor however, a varnish-like aroma was detected by a sensory panel. Coatings of wheat gluten and soy proteins were more effective than films in controlling lipid oxidation on precooked patties (Wu et al., 2000).

The use of lipids (waxes, fats and oils) in coatings has been practised for centuries. Lipids are used for their hydrophobic character as water vapor barriers. In the case of meats, coatings should be as impervious to water vapor and oxygen as possible to prevent moisture loss and oxidation; in the case of fresh fruit and vegetables care must be taken to allow adequate respiration. Patent claims reported that formulations of acetylated monoglycerides with different degree of acetylation maintain color and overall quality of refrigerated beef, pork and poultry meats for longer periods than controls. However, certain application and sensory problems have also been reported, including the tendency to crack and flake during refrigerated and frozen storage of highly saturated acetylated monoglycerides, and to exhibit acidic or bitter aftertaste. Problems associated to oxidation of unsaturated glycerides are reported as well. Coating efficiency depends not only on the chemical structure, degree of saturation and physical state of the lipids but also on their homogeneity in the film. Lipids in general have no influence on mechanical properties of films but some of them (acetoglycerides, fatty acids, monoglycerides, phospholipids) are often used as plasticizers. Plasticizer increase flexibility by weakening the intermolecular forces between adjacent polymer chains (Callegarin et al., 1997).

Composite coatings are blends of polysaccharides, proteins and/or lipids and may be formed from emulsions in a one-step process, more desirable for industrial settings or as laminates in a multistep process with better barrier properties. The goal of multicomponent coatings is to combine the desirable properties of different materials to improve nutritional value, permeability characteristics, strength, flexibility and general performance of coating formulations. In general, edible films and coatings have lower barrier and mechanical properties than plastic films, but their main advantages are that they can be eaten and are nonpolluting because they are maid from biodegradable products. For this reason, both research and industry people is trying to find new formulations to improve edible films and coatings performance.

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