Traditional and Modern Sources of Ingredients in the Halal Industry
"Innovation in food packaging"

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ABSTRACT

Recently, the demand for safe and high quality foods, as well as changes in consumer preferences have led to the development of innovative and novel approaches in food technology. One such development is the smart or intelligent food packaging technology. Many new "extra" functions have been introduced in the active and intelligent packaging technologies. Active and intelligent packaging systems aim to extend the shelf life of food products by maintaining their quality longer, increase their safety by securing foods from pathogens and bioterrorism, and enhance the convenience of food processing, distribution, retailing and consumption. Many raw materials used in the active and intelligent packaging systems are questionable for Muslims such as enzymes, gelatin, fatty acids, amino acids, ethanol, flavor, emulsifiers, antioxidants, preservatives etc... Muslim awareness regarding to food industry must increase, and they have to take their right in consume halal food, because halal consumer right is the unique and fundamental faith issue for Halal life system.

Introduction

Halal is one of the most important foundations of Muslim life. From the day of birth until death, a Muslim's target must be living in that circle and complying with the halal food. The first human being and Prophet, Adam (pbuh) had taken a bite of a fruit from a forbidden tree upon Satan's tricks and lost the test which resulted of them to be taken out of heaven. If we re-consider this event and think about it thoroughly, we may comprehend the importance of Halal Food for humanity. Not long ago, just 60-70 years ago from today, when we were living based on our traditions; we did not have to worry about halal. In 1960s, manufacturing and consuming became two pillars of Capitalist life style. Each year passed by making this life style more dominant on other cultures, nations and religious parties worldwide. Capitalist's mass production and mass consumption life style became very effective and prominent. The western lifestyle / modernity started being imposed by its own channels to other nations, cultures and religious parties. Using pork related products widely on all production lines, using dead animals as much as possible, consuming more of food additives

as a shortcut to achieve the financial goals, changing the hormones and modifying genes of organisms became the bad habit of Capitalist motivated industries.

Packaging is one of the most important processes to maintain the quality of food products for storage, transportation and end-use. It prevents quality deterioration and facilitates distribution and marketing. The basic functions of packaging are protection, containment, information and convenience. Packaging technology has attempted to reduce the volume and/or weight of materials in efforts to minimize resources and costs.

Many new "extra" functions have been introduced in active packaging technologies, including oxygen-scavenging and intelligent functions, antimicrobial activity, atmosphere control, edibility, biodegradability etc. Food packaging performs beyond its conventional protective barrier property. The new active packaging systems increase security, safety, protection, convenience, and information delivery. Active packaging systems extend the shelf life of food products by maintaining their quality longer, increase their safety by securing foods from pathogens and bioterrorism, and enhance the convenience of food processing, distribution, retailing and consumption.

Active packaging techniques

Food condition in the definition of active packaging includes various aspects that may play a role in determining the shelf life of packaged foods, such as physiological processes (e.g., respiration of fresh fruit and vegetables). Chemical processes (e.g., lipid oxidation), physical processes (e.g. staling of bread, dehydration), microbiological aspects (e.g. spoilage by micro-organisms) and infestation (e.g., by insects). Through the application of appropriate active packaging systems these conditions can be regulated in numerous ways and, depending on the requirements of the packaged food, food deterioration can be significantly reduced. I

Active packaging techniques for preservation and improving quality and safety of foods can be divided into two main categories; absorbers (i.e. scavengers) (Table 1) and releasing systems (Table 2). Absorbing (scavenging) systems remove undesired compounds such as oxygen, carbon dioxide, ethylene, excessive water, taints and other specific compounds. Releasing systems actively add or emit compounds to the packaged food or into the bead-space of the package such as carbon dioxide, antioxidants and preservatives.

Table 1. Examples active packaging systems for preservation and shelf-life extension of foods or improving their quality and usability for consumers.

Packaging type	Examples of working Principle/mechanism/reagents	Purpose	Examples of possible applications
Oxygen absorbers (sachets. labels films)	Ferro-compounds. ascorbic acid, metal salts, glucose oxidases, alcohol oxidase	Reduction/prevention mould, yeast and aerobic bacteria growth. Prevention of oxidation of fats, oils, vitamins, colors. Prevention of damage by worms, insects and insect eggs	Cheese, meat products. Ready-to-eat products. Bakery products, coffee, tea. nuts, milk powder
Carbon dioxide absorbers (sachets)	Calcium hydroxide and sodium hydroxide or potassium hydroxide Calcium oxide and silica gel	Removing of carbon dioxide formed during storage in order to prevent bursting of a package	Roasted coffee Beef jerkey Dehydrated poultry products
Ethylene absorbers (sachets. films)	Aluminium oxide and potassium permanganate (sachets) Activated carbon + metal catalyst (sachet)	Prevention of too fast ripening and softening	Fruits like apples, apricots, banana, mango, cucumber, tomatoes, avocados
Humidity absorbers (drip absorbent sheets, films. sachets)	Polyacrylares (sheets) Propylene glycol (film) Silica gel (sachet) Clays (sachet)	Control of excess moisture in packed food. Reduction of water activity on the surface of food in order to prevent the growth of moulds, yeast and spoilage bacteria	Meat, fish, poultry, Bakery products, cuts of fruits and vegetables
Absorbers of off-flavors, amines and aldehydes	Cellulose acetate film containing nariginaze enzyme. Ferrous salt and citric or ascorbic acid.	Reduction of bitterness in grapefruit juice Improving the flavor of fish and oil-containing food	Fruit juice fish and oil-containing food
Lactose remover	Immobilized lactase in the packaging material	Serving milk product to the people suffering lactose intolerance	Milk and other dairy products
Cholesterol remover	Immobilized cholesterol reductase in the packaging material	Improving the healthiness of milk products	Milk and other dairy products

Table 2. Examples of sachet and film type releasing active packaging systems for preservation and shelf-life extension of foodstuffs or improving their quality.

Packaging type	Examples of working Principle/mechanism	Purpose	Examples of possible applications
Carbon dioxide emitters (sachets)	Ascorbic acid Sodium hydrogen carbonate and ascorbate	Growth inhibition of gram-negative bacteria and moulds	Vegetables and fruits, fish, meal, poultry
Ethanol emitters (sachets)	Ethanol/water mixture absorbed onto silicon dioxide powder generating ethanol vapour	Growth inhibition of moulds and yeast	Bakery products (preferably heated before consumption) Dry fish
Antimicrobial preservative releasers (films)	Organic acids, e.g. sorbic acid Silver zeolite Spice and herb extracts Allylisorhiocyauate Enzymes, e.g, lyzozyme	Growth inhibition of spoilage and pathogenic bacteria	Meat, poultry, fish. bread, cheese. fruit and vegetables
Sulphur dioxide emitters (sachets)	Sodium metabisulfite incorporated in microporous material	Inhibition of mould growth	Fruits
Antioxidant releasers (films)	BHA BHT Tocopherol Maillard reaction volatiles	Inhibition of oxidation of fat and oil	Dried foodstuffs Fat-containing food stuffs
Flavouring emitters (films)	Various flavours in polymers	Minimisation of flavour scalping Masking off-odours Improving the flavour of food	Miscellaneous
Pesticide emitters (the outer or inner layer of packaging material)	Imazalil Pyrethrins	Prevention of growth of spoilage bacteria Fungicidal or pest control	Dried, sacked foodstuffs, e.g., flour, rice, grains

Intelligent packaging techniques

Intelligent packaging systems defined as packaging systems that monitor the condition of the packaged food to give information about the quality during transport and distribution (Table 3). They can be so-called external indicators, i.e., indicators which are attached outside the package (time- temperature indicators), and so-called internal indicators which are placed inside the package, either to the head-space of the package or attached into the lid (oxygen indicators for indication of oxygen or package leak, carbon dioxide indicators, microbial growth indicators and pathogen indicators).

There are several reasons for the bright future of intelligent packaging:

• The significance of freshness and safety will increase.

• The demands of consumers will increase.

• Globalisation and expansion of the marketing area make logistic chains longer placing more demands on traceability.

Table 3. Examples of external and internal indicators and thier working principle or reacting compounds to be used in intelligent packaging for quality control of packed food.

Indicator	Principle/reagents	Gives information about	Application
Time-temperature indicators (external)	Mechanical Chemical Enzymatic	Storage conditions	Foods stored under chilled and frozen conditions
Oxygen indicators (internal)	Redox dyes pH dyes Enzymes	Storage conditions	Foods stored in packages with reduced oxygen concentration
Carbon dioxide indicator (internal)	Chemical	Storage conditions Package leak	Modified or controlled atmosphere food packaging
Microbial growth indicators (freshness indicators) (internal/external)	pH dyes. All dyes reacting with certain metabolites (volatiles or non-volatiles)	Microbial quality of food (i.e. spoilage)	Perishable foods such as meat, fish and poultry
Pathogen indicators (internal)	Various chemical and immunochemical methods reacting with toxins	Specific pathogenic bacteria such as *Escherichia coli* 0157	Perishable foods such as meat, fish and poultry

Antimicrobial packaging:

Antimicrobial packaging is the packaging system that is able to kill or inhibit spoilage and pathogenic microorganisms that are contaminating foods. The new antimicrobial function can be achieved by adding antimicrobial agents in the packaging system and/or using antimicrobial polymers that satisfy conventional packaging requirements. When the packaging system acquires antimicrobial activity, the packaging system (or material) limits or prevents microbial growth by extending the lag period and reducing the growth rate or decreases live counts of microorganisms. Chemical antimicrobial agents are the most common substances used in the industry. They include organic acids, fungicide, alcohol and antibiotics. Organic acids such as benzoic acids parabens, propionic acid, acetic acid, lactic acid and fatty acids

Edible film and coating

Edible films and coatings are produced from edible biopolymers and food-grade additives. Film-forming biopolymers can be proteins, polysaccharides (carbohydrates and gums) or lipids. Plasticizers and other additives are combined with the film-forming biopolymers to modify the physical properties or functionality of films.

Edible films and coatings enhance the quality of food products, protecting them from physical, chemical, and biological deterioration. The application of edible films and coatings can readily improve the physical strength of food products, reduce particle clustering, and improve visual and tactile features on product surfaces. It can also protect food products from moisture migration, microbial growth on the surface, light-induced chemical changes, oxidation of nutrients etc... Most commonly, edible films and coatings function as barriers against oils, gases or vapors, and as carriers of active substances, such as antioxidants, antimicrobials, colors, and flavors

Table 4. Material used for edible films and coatings

Functional compositions	**Materials**
Film-forming materials	***Proteins***: collagen, gelatin, casein, whey protein, corn zein, wheat gluten, soy protein, egg white protein, fish myofibrillar protein, sorghum protein, pea protein, rice bran proteip, cottonseed protein, peanut protein ***Polysaccharides***: starch, modified starch, modified cellulose (CMC, MC, HPC, HPMC), alginate, carrageenan, pectin, pullulan, chitosan, xanthan gum ***Lipids***: waxes (beeswax, paraffin, carnauba wax, candelilla wax, rice bran wax), resins (shellac, terpene), acetoglycerides
Plasticizers	Glycerin, propylene glycol, sorbitol, sucrose, polyethylene glycol, corn syrup, water
Functional additives	Antioxidants, antimicrobials, nutrients, nutraceuticals, pharmaceuticals, flavors, color
Other additives	Emulsifiers (lecithin, Tweens, Spans), lipid emulsions (edible waxes, fatty acids)

Innovative Food packaging and halal industry

Packaging is one of the most important processes to maintain the quality of food products for storage, transportation and end-use. Packaging is a growing source of porcine contamination for halal foods as a result of animal fat-based lubricants used in production of some packaging materials leaching into food.

There are huge raw materials enter in the manufacturing of food packaging, which may contain alcohol or animal derivatives (such as enzymes, collagen, gelatin, casein, whey protein, glycerin, fatty acids) including pork, which is prohibited from Islam point of view.

To comply with halal requirements, packaging materials must not contain traces of banned - or haram – substances, such as pork and alcohol.

Muslim awareness regarding to food industry, including food packaging must increase, and they have to take their right in consume halal food, because halal consumer right is the unique and fundamental faith issue for Halal life system.

Conclusion

Halal is one of the most important foundations of Muslim life. From the day of birth until death, a Muslim’s target must be living in that circle and complying with the halal food. It is very probable that in the future the management of the food supply chain will be based on wireless communication and active, intelligent, and communicating packages. The packages will protect the food without additives, inform about the product quality and history in every stage of the logistic chain, guide the journey of the package, reduce product loss, and will give real-time information to the consumer about the properties/quality/use of the product.

However, above all, as utilizing all materials which use in our daily life, packaging materials also should be suitable for Muslim's usage.

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