INNSPUB
International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 6, No. 3, p. 15-30, 2015

REVIEW PAPER OPEN ACCESS

A comprehensive surviving on application and diversity of biofilms in seafood

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Key words: Biopolymer, Biofilm, shelflife, seafood, coating.

http://dx.doi.org/10.12692/ijb/6.3.15-30 Article published on February 07, 2015

Abstract

Spoilage of seafood products especial fish happens by chemical and sensory quality changes. Biochemical reactions for example lipids oxidation, reactions due to activities of the fish's own enzymes, and the metabolic activities of microorganisms due to deterioration of food. These activities cause to a short shelf life in fish and other seafood products. Biofilm defined a thin continuous layer of polymers on food surfaces which protect food products against the many factors/located on food surfaceand makes them more difficult to decline. Edible coatings can improve the quality of fresh, frozen, and processed seafood products. This paper reviews the application of various types of biopolymer films for example lipid, polysaccharide and protein-based edible coatings, and enriched edible film with natural extract in seafood products.

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Introduction

Edible films can be defined as thin continuous layer of biopolymer materials which can be used as a coating on food products to protect them against from water loss, vital gasses exchanging and lipid oxidation. Polymers were divided in four groups. First, polymer obtained from plant biomass such as cellulose, polysaccharides, starches, plant proteins, pectin, chitosan and gums or with animals source such as casein, whey, collagen/gelatin). Second polymers obtained by microbial production such as poly (hydroxyl alkanoates) (Valdez *et al.*, 2014). Next, polymers synthesized chemically from agro-resources for example poly (lactic acid) and finally polymers obtained by chemical synthesis from fossil resources such as poly (caprolactone), poly (esteramides) (valdez *et al.*, 2014). Nowadays biopolymer films have received more attention because of their benefits versus synthetic films. At the present, consumers demand has been increased for high quality food with an extended shelf life without chemical compounds. Biopolymers materials generally have good oxygen barrier under dry conditions. Films or coating generally made of proteins, lipids and polysaccharides to extend the shelf-life of seafood and conserve the quality of fish muscle by preventing moisture losses and gasses exchanging. (Stuchell and Krochta, 1995; Gennadios and Hanna, 1996; Jeon *et al.*, 2002; Sathivel, 2005; Fan *et al.*, 2008; Artharn *et al.*, 2009; Fan *et al.*, 2009; Song *et al.*, 2010). Film formation and properties for several polysaccharide, protein, and lipid films have been reviewed before (Kester and Fennema, 1986). Commercial usages of biodegradable coatings consist of waxes, oils, resins, collagen, corn zein, cellulose and gelatin films explained in detail before (Anon *et al.*, 1995). Edible biopolymer technology helps food industries to make their products more attractive and safe to use. Cellulose, the most biopolymer in the world, and cellulose-derivative-based edible films are very efficient because of oxygen and hydrocarbon barriers, and aroma compounds. Cellulose derivatives for example methylcellulose are more important because of their ability to forming a continuous matrix (Ariaii *et al.*, 2014). According to some research findings among biopolymers, starch is the most interesting for food packaging because of commercially availability (Valdez *et al.*, 2014). This overview research discusses the rationales of using edible films, different types of films and coating applications in seafood products and mention to antioxidants and antimicrobials properties of edible coatings and introduced newest edible coatings films enrich with antioxidants as a novel system for food coating which can be replace by synthesis materials. This review article discussed Properties of Protein, lipid, polysaccharides and microbial -Based film used in sea food products in detail. At the present time a comprehensive surviving on application and mention to diversity of vast rang of biofilms in seafood seems be necessary.

Rationales using of Biofilm and coating types

To improve the food quality, nutritional value and increasing shelf life coating the seafood's has been researched as an effective method (Matuska *et al.*, 2006). Decreasing moisture loss during cold storage of fresh or frozen seafood products, preventing flavor and color changes, hold in juices, prevent dripping, enhance product presentation, and eliminate the need for placing absorbent pads are the most reasons for using biofilms. Biofilms and coating seafood products could reduce the load of pathogenic microorganisms at the surface of coated foods. By using biofilm coating seafood volatile flavor loss could be restricted respectively. Antioxidants and antimicrobials properties are the most characters of edible coatings so can be used for direct treatment of food surfaces (Issa Khan *et al.*, 2013). Coatings can be obtained by dipping, brushing and spraying on products or by making film from solution by thermo formation processing (Gontard and Guilbert, 1994). Coatings could be done directly to the food surface or they may be applied into films that are then used to coat the surface of the food (Stuchell and Krochta, 1995, Oussalah *et al.*, 2004, Sathivel, 2005; Gomez *et al.*, 2007). The product can be absorbing proper amount of coating solution for forming protective layer. Absorption of coating solution depends on its concentration. Biofilm thickness defined less than 0.3 mm respectively. For evolution film quality plasticizer compound for example glycerol, mannitol, sorbitol and sucrose could be added to coating solution. Coatings should have good adhesion to rough surfaces (Hershko *et al.*, 1996).

Use of natural extracts in biopolymer films

Now, edible coatings are developed as a new system to be replaced by synthesis materials to reduce their application. Recently because of some edible biofilm properties such as raised consumer require for more natural food, non-toxic properties, non-polluting effects, edibility, increasing nutrition value, coatings control moisture, preservation product aroma and flavor and having Simple technology and low cost increased using in food industrial (Mirnezami and Ziabari, 2002; Sathivel *et al.*, 2007; Raeisi *et al.*, 2014).Edible films provide strengthening of natural layers to hold up moisture losses, while selectively permitting for controlled exchange of vital gases, such as O_2, CO_2, and ethylene. In vast range of food products, Fish muscle, is very sensitive to lipid oxidation and microbial pollution so edible films are important for preservation of seafood products (Kilincceker *et al.*, 2009; Rostami *et al.*, 2010). The vast ranges of finding were demonstrated increasing seafood shelf life by using films enriched by natural extracts. The experimental results indicated directly effect of *Kaempferia rotunda* essential oil on increasing shelf life of seafood products (Woerdenbag *et al.*, 2004). Before research results for example thymol and carvacrol (Mahmoud *et al.*, 2004), applying thyme powder (Attouchi and Sadok, 2010), usage rosemary and garlic essential oil (Guerrero *et al.*, 2011), extract of seaweed (Husni *et al.*, 2013) and essential oil of *Zataria multiflora* (Rahimabadi *et al.*, 2013) conducted too. Raeisi *et al* (2014) survived antioxidant effect of *Zataria multiflora* essential oil and grape seed extract in carboxymethyl cellulose coating on rainbow trout meat. The results of this experiment showed that use of these two natural antioxidant factors decreased fish rainbow trout (*Oncorhynchus mykiss*) meat chemical reactions in the storage period. Evaluation of a film made from chitosan incorporated with cinnamon essential oil was investigated by Ojagh *et al* (2010). Their finding indicated improving antimicrobial activity by incorporating film with cinnamon essential oil, Therefore chitosan coating warped with cinnamon oil provides a type of active coating that can be utilized as a safe preservative for fish rainbow trout (*Oncorhynchus mykiss*) under refrigerated storage. The effect of biopolymer gelatin- chitosan film combined with clove oil as antimicrobial agents were investigated for storage of cod (*Gadus morhua*). The obtained results exhibited films containing clove oil prevent the growth of all microorganisms thus fish shelf life was prolonged. Tolouie*et al* (2013) investigated applying α-tocopherol into chitosan film to reduce lipid oxidation in the farmed trout. Obtained results demonstrated fish rainbow trout (*Oncorhynchus mykiss*) fillets coated by chitosan enriched with α-tocopherol at any level exhibited less rapidly lipid damages rather than control. Ariaii *et al* (2014) findings about biodegradable polysaccharide-based film were expanded by combining *Pimpinella affinis* essential oil into methyl cellulose demonstrated significant antibacterial activates. Edible coating divided into four groups consists of protein coating, lipid coating polysaccharide coating and finally composite coatings. Changing quality of rainbow trout fillets during cold storage condition with edible film enriched by quince seed mucilage survived by Joukia *et al* (2014). Finding showed that lipid oxidation decreasing in fillets wrapped with quince seed mucilage film whit preservation color characteristics significantly. The experimental result demonstrated fillet samples with quince seed mucilage films presented a significant reduction in pH too (Joukiai *et al.*, 2014). The effects of cassava starch-based edible film warped with *Kaempferia rotunda* and *Curcuma xanthorrhiza* essential oil on patin fillets quality during refrigerated storage were survived by Utami *et al* (2014). The results demonstrated that natural extracts added to film were able to preserve the patin fillet's quality and increased its shelf life (Utami *et al* 2014). Active components incorporated directly into biofilms mentioned in (Table 1) in details.

Properties of Protein-Based film

The edible films can be obtained from protein, lipid and polysaccharide source. Among all edible films, edible protein-based films introduced most efficient. They have higher barrier properties than films produced from lipids and polysaccharides (Shatalov *et al.*, 2014). However, poor stability of the protein films to water vapor and their low mechanical strength are limited their using in food packaging. Protein films have been made from rehabilitation resources, such as casein, zein, gluten, keratin, collagen, gelatin, collagen and etc. special properties of proteins include hydrophobic properties, crystallinity, surface charge, molecular size and three-dimensional shape proper its usage as coating for protect food from chemical or microbial damage and delay food spoilage. Protein coating could be act as vapor, O_2 and CO_2 barrier and contained of three agents: protein, plasticizer and solvent materials (Lee *et al.*, 2002). They can decrease the complexity of packaging systems, making them either easier to recycle. Now modifying the structure of the protein films by warping natural or synthetic compound is regularly. New approach for modifying the structure of the protein films defined Appling enzymatic methods, and a special place among them introduced use of microbial transglutaminase. The results demonstrated use of microbial transglutaminase evaluated mechanical properties of protein film (Shatalov *et al.*, 2014).

Gelatin film

Gelatin known as soluble protein can be originated from thermal denaturation of skin and bones collagen of fish respectively. Recently, gelatins used have been increased as film and coating, especial for obtaining of biodegradable or edible films. The largest advantage of gelatin is that it is inexpensively available by extraction from seafood processing wastes. At the present time gelatins compounds were used as foaming agents, biofilm, emulsifiers and stabilizer agent (jahani *et al.*, 2014). Highly hydrophilic and barrier properties of gelatin demonstrate before, so it has been introduced as efficient film in food industrials. Progressive in evolution gelatin-based biofilms for increasing seafood shelf life with improved mechanical and water barrier characters by combining gelatin with other polymers survived before (Jahani *et al.*, 2014). Ojagh *et al* (2010) studied application of a fish rainbow trout (*Oncorhynchus mykiss*) gelatin–lignin film on Atlantic salmon muscle. The experimental finding indicated that, the use of high pressure in combination with gelatin- lignin film, improved the sensory quality of trout fillets. Ojagh *et al* (2011) explained Lessening of high-pressure-induced changes in Atlantic salmon trout by the combined use of a fish rainbow trout (*Oncorhynchus mykiss*) gelatin–lignin film. The results indicated that lipid oxidation decreased and extended shelf life of fish fillets. Evolution antioxidant and antimicrobial properties of gelatin films by warping natural extracts for example essential oil explained before (Solorzano *et al.*, 2012, Jahani *et al.*, 2014). Jahani *et al* (2014) survived the effect of gelatin films antioxidant and antimicrobial properties warped by different constructions of *Trachyspermum ammi* essential oil. Experimental results showed that antioxidant characters of the gelatin coating incorporated with *Trachyspermum ammi* essential oil were improved. Javadian *et al* (2014) improved native/Coldwater fish gelatin properties by adding ribose sugar and recommended improved fish gelatin film efficient for commercial uses. The obtained findings showed that native fish gelatin functional characters improved with mixing by ribose sugar. According to the results fish gelatin solubility, moisture content and monolayer water content of the matrixes were decreased by adding ribose (Javadian *et al*, 2014). Since poor water resistance is the most gelatin fish disadvantage, increasing water vapor barrier property of gelatin films of fish skin incorporated with three essential oils investigated by Tongnuanchan *et al* (2014). Natural extract from basil, plai and lemon source added to gelatin film. The obtained results showed that lower water vapor permeability decreased by using essential oils in comparison with the control treatment, and basil and lemon essential oils were more efficient for this mean respectively (Tongnuanchan *et al.*, 2014).

Collagen film

Collagen is the main protein constructing in vertebrate animals. Collagen is also a well-known high biodegradable and biocompatible material and used as biofilm coating. Collagen films were obtained from fish skin, bone or scales and has been widely survived for usage as a film due to its especial characters. The most mentioned properties of collagen consist of good biocompatibility, low antigenicity, and high biodegradability respectively (Yamamoto *et al.*, 2014). Collagen originated from fish source is an effective material as a biodegradable scaffold. Fish collagen has a wide range of applications in leather and film industries and introduced with lower thermal stability because of fish collagen contain amino acid content.

Table 1.

Edible coating	Active compound	References
Chitosan coating	Cinnamon essential oils	Ojagh *et al* (2010)
Chitosan coating	Mineral or vitamin	Park and Zhao (2004)
Chitosan Coating	Calcium salts and glucono-*a*-lactone	Park *et al* (2001)
Chitosan coating	Tea tree essential oil	Sanchez-Gonzalez *et al* (2010).
Chitosan coating	Green tea extract	Siripatrawan and Harte (2010)
Chitosan coating	Zataria multiflora Boiss essential oil and grape seed extract.	Moradi *et al* (2012).
Methylocelullose, chitosan	Sodium benzoate potassium sorbate	Chen *et al* (1996)
Gelatin-based films with or Without chitosan.	Rosemary or oregano essential oils	Gomez-Estaca *et al* (2007)
whey protein	Lysozyme	Min *et al* (2008)
whey protein	Cinnamon essential oils	Bahram *et al* (2012)
Alginate-based edible coating	Thyme oil and *trans*cinnamaldehyde	Ouattara *et al* (2001)
Alginate-calcium coating	Vitamin C (Vc) and tea polyphenols (TP)	Song *et al* (2011)
Soyprotein Films	Grape seed extract, nisin, and EDTA	Sivarooban *et al* (2008)
Soy or whey protein coating	α-Tocopherol	Tolouie *et al* (2013)
Starch-chitosan composite film	Nisin and EDTA	Lu *et al* (2009)
K-carrageenan films	Saturejahortensis essential oil	Shojaee-Aliabadi*et al* (2013)

Edible film whey protein

According to documented reports the frozen fish common Kilka (*Clupeonellia delitula*) packs were mostly frozen for less than three months because longer frozen storage period may cause to surface dryness and color changes (Motalebi and Syfzadeh, 2011). First symptoms of quality reduction happen after only one month of frozen storage period. There was showed a 3.5% decline in fish weight after three months of frozen storage (Moradi, 2010). Seems use of edible films for example whey protein can be an efficient way for long storage fish preservation. Whey protein is obtained from milk processing and is combined from protein, lactose and inorganic salts (Motalebi and Syfzadeh, 2011). Using of edible film whey protein in food industrials documented before by Stuchell (1995), Min (2008) and Hassan Zati (2010). Morrissey *et al* (2009) demonstrated whey protein has strong anti-bacterial properties with preservation of food moisture. Whey protein film has been used for increasing shelf life of Kika, Salmon and other frozen fish-fillet (Motalebi and Syfzadeh, 2011). Delaying spoilage, preservation sensory quality, decreasing lipid oxidation so increasing food products shelf life storage were defined by using edible film whey protein. Motalebi and Syfzadeh (2011) explained the effects of edible film whey protein on the chemical, antibacterial, sensory quality and shelf life of frozen common Kilka obtained results indicated of covered samples showing lower bacterial contamination had a suitable sensory characters to end of cold storage period but the control samples had lost their quality after three months. The effects of whey protein coating on chemical and physical properties of gutted Kilka during frozen storage survived by Rostami *et al* (2010). Fish (kilka) fillet was coated by dipping in whey protein solution with different concentrations. The experimental results demonstrated that coating process with different whey protein concentration was caused to decrease in peroxide value and increase the iron content. Rostami *et al* (2010) documented coating process with different whey protein concentration leads to decrease in peroxide value and increase the iron content of the seafood products. Stuchell *et al* (1995) evaluated whey protein isolate and acetylated mono glyceride coating for reduction moisture loss and lipid oxidation in King salmon (*Oncorhynchus tshawytscha*). Their results showed that the coating of mono acetylated and soluble whey protein reduced moisture loss rate during cold storage, respectively. The injection of lysozyme to the film from whey proteins was investigated in smoked salmon. The findings explained that antibacterial properties of film increased respectively (Min *et al.*, 2008). Rodriguez-Turienz *et al* (2011) carried out study to determine effect of different whey protein concentrate coating percent on frozen Atlantic salmon. According to the results protein coatings delayed lipid oxidation of salmon fillets, providing better protection against it than water glazing and sensory quality of salmon fillets was not changed by to the end of storage. An effect of whey protein-based edible films (ultrasound-treated whey proteins) on frozen Atlantic salmon (*Salmo salar*) was documented by Rodriguez-Turienz *et al* (2012). Their findings demonstrated that whey based coating can decrease lipid oxidation in fish without chemical additives. In another study researched the effect of ascorbic acid combined with whey protein film on the shelf-life of rainbow trout stored at refrigerator temperature. The result indicated that antibacterial activity of whey protein edible coating increased and the shelf-life of fish/ rainbow trout fillets extend by film usage (Ojagh *et al.*, 2011).

Properties of Lipid-Based Films

In the last two decade, there has been more attention to edible packaging. Most work deals with water vapor transfer. Lipids coating for example waxes, Laces, Fatty acids and alcohols, Acetylated glycerides and their derivatives are applied in manufacture of these types of packaging materials. Lipids decreasing efficiency can be described by the chemical combination of the molecules, such as presence of polar components, hydrocarbon chain length, and number of unsaturation or acetylation. (Mchugh and Krochta 1994 a, b). Edible film such as lipids and waxes depended on hydrophobic characters increased specifically for reduction moisture loss from fresh product surface (Morillon *et al.*, 2002). Waxes often are used for controlling water loss from fresh fruit and vegetable and increasing product attractiveness. In the food industry, waxes are used to improve surface appearance (color, sheen, and gloss) and reduce surface stickiness. Emulsifier's factors are sometimes used as barriers to gases and moisture on seafood products. Lipids may also be added to film for increase surface adherence between the film and products. It was demonstrated that Silver salmon fillets coated by acetylated monoglyceride exhibited the lost vapor less and lower lipid oxidation rather than control treatment during frozen storage (Hirasa, 1991). In another study aqueous emulsion of Myvacet, calcium Caseinate and hydroxypropyl methylcellulose were also survived as protective film on fish fillets (Hirasa, 1991). The findings showed that coated fillets exhibited less moisture loss than control (Hirasa, 1991). Samples coated by Caseinate were more flexible. Gasses exchanging and vapor losses were more Caseinate coating than Myvacet (Hirasa, 1991). Stuchell and Krochta (1995) survived the effects of acetylated monoglyceride coatings compared with acetylated monoglyceride/whey protein coatings on moisture loss and lipid oxidation in frozen King salmon. Finding indicated that acetylated monoglyceride coatings were more flexible at low temperatures than Myvacet films.

Properties of Polysaccharides-Based Film

Polysaccharides such as starch, cellulose and chitosan were used as coating layer. Polysaccharide gums are hydrocolloids of considerable molecular weight, and are water-soluble. Due to their hydrophilic nature, polysaccharide films generally exhibit limited water vapor barrier ability respectively. Carboxymethyl cellulose is a water-soluble polysaccharide with appropriate biodegradable and edible film-forming properties and can be produced at low cost and large scale from different resources (Raeisi *et al.*, 2014). Polysaccharides dissolve in and form intensive hydrogen bonds with water. Because of Polysaccharide molecules size and configuration, these polysaccharides have the ability to gel aqueous solutions as a result of both hydrogen bonding between polymer chains and intermolecular friction. In general, certain polysaccharides, applied in the form of gelatinous coatings, can delay moisture loss from coated products (Kester and Fennema, 1986). Polysaccharide compounds in seafood processing divided to Pectin, Starch, Cellulose derivatives, Gum microbial and Agars. Alginates Carrageenans, Dextrans, because of their importance described in detail below.

Chitosan

Chitosan described as nontoxic, natural and biodegradable components with a broad range of commercial usages such as chemistry, biotechnology, medicine and agriculture (Alasalvar *et al.*, 2002; Kurita, 2006; Barrow and Shahidi, 2008). Biocompatibility and biodegradability were defined as most advantage for this biopolymer. Chitosan is a linear polysaccharide which its antimicrobial characteristics is influenced by kind of chitosan, degree of polymerization, and environmental conditions (Majeti and Kumar, 2000; Ortega *et al.*, 2014). In general chitosan has been used in antimicrobial films to provide edible protective coating. Dutta *et al* (2009) demonstrated chitosan high antimicrobial activity against a wide variety of microorganisms, including fungi, and Gram-positive and Gram-negative bacteria properties (Lim and Hudson, 2003; Shahidi and Abuzaytoun, 2005; Augustini and Sedjati, 2007; Mohan *et al.*, 2012). Tsai *et al* (2002) survived antimicrobial activity of chitin and chitosan and applications of fish preservation and their finding exhibited antimicrobial activities of both chemically prepared and microbiologically prepared chitin and chitosan were similar. The result of this experiment showed that chitosan has a stronger activity against bacteria rather than versus fungi agents (Tsai *et al.*, 2002). Chitosan has also been documented to have film-forming characters for use as edible films (Butler *et al.*, 1996; Jeon *et al.*, 2002; Nadarajah *et al.*, 2006). Improving seafood shelf life by applying chitosan coating has been exhibited before by Estaca *et al* (2010) and Gunl and koyun (2013). Before studies conducted chitosan could be modified the internal atmosphere of food product as well as decreasing the vapor losses and could be operated more effective than chitin (El Ghaouth *et al.*, 1991; Zhang and Quantick 1997, Shahidi and Abuzaytoun, 2005). Jeon *et al* (2002) documented that chitosan film reduced seafood vapor loss and lipid oxidation during storage condition. the effect of chitosan solutions on frozen salmon protection with that of water glazing results showed that chitosan coatings could be an excellent barrier to protect frozen fish from deterioration and demonstrated with the use of 0.5% and 0.75% chitosan solutions could be obtained more efficient results in preventing salmon weight loss (Soares *et al.*, 2013). Different studies have explained that lipid oxidation in fish products may be course through the application of chitosan films (Tsai *et al.*, 2002; Jeon *et al.*, 2002; Sathivel *et al.*, 2007; Ojagh *et al.*, 2010). The effect of chitosan film or vacuum and modified atmosphere packing on microbial, chemical and lipid oxidation properties of Atlantic bonito (*Sarda sarda*) fillets stored at 4±1°C for 15 days survived by Alak *et al* (2010). The results showed that bacteria pollution in fillet packaged with chitosan film was more slower rather than control treatment and lowest average pH value among the treatments so could be improve fish shelf life. Kamil *et al* (2002) examined chitosan antioxidant properties in different concentration on herring (*Clupea harengus*). The reported results demonstrated chitosan was most effective in preventing lipid oxidation, so herring shelf life increased. This study was similar to Kim and Thomas (2007) findings that concluded anti oxidative effects of chitosan. Tsai *et al* (2002) and Sathivel (2005) documented similar reports about chitosan concentration in pink salmon (*Oncorhynchus gorbuscha*) preservation too. The antibacterial effect of different concentrations of chitosan and chitosan nanoparticles coating on fish fingers during frozen storage were survived by Abdou *et al* (2012). The results indicated that using of chitosan and chitosan nanoparticles in different concentrations enhance microbiological quality of fish fingers and increase the shelf life. The effect of chitosan- gelatin composite film on rainbow trout fillets (*Oncorhynchus mykiss*) during refrigerated storage was investigated by Nowzari *et al* (2013). The results demonstrated good sensory quality and increasing shelf life of fish fillets by using composite coated during refrigerated storage.

Alginate

Alginates are extracted from brown algae named *Macrocystis pyrifera* (Lu *et al*., 2009) known as a salt of alginic acid, a polymer of Sodium alginate films. Alginate is potential biopolymer with their unique aspects to elevate emulsion permanence. Water resistance is the most positive physical and mechanical character of alginates in food processing (Rhim, 2004). Alginate is a favorable film, which preserve food taste, aroma, flavor and color. It can be improve nutrient value of the product such as essential vitamin and free amino acids. According to last finding alginate can prevent the activity of enzymes, it is the best coating among synthetic protein coatings (Ranken and keil, 1999; Kazemi Islamian, 2003). For protection frozen fish from oxidation process in commercial scale used alginate gelled by calcium cautions (Anon, 1995). Alginate coating could be elongate seafood products shelf life such as fish, shrimp and scallop with maintaining the properties during frozen storage (Wanstedt *et al*., 1981; Wang *et al*., 1994; Zeng and Xu,1997; Yu *et al*., 2008). Increasing kika shelf life by application Sodium alginate with Reduction of total volatile nitrogen, decreasing oxidation process and reduction of moisture loss rate reported before (Khanedan *et al*., 2011). The effect of alginate-based edible coating enriched Vitamin C and tea polyphenols for increasing shelf-life of bream (*Megalobrama amblycephala*) was survived before (Song *et al*., 2010). Total volatile nitrogen, moisture loss, thiobarbituric acid, microbiological, chemical and other essential factors were analyzed. The results showed that coating treatments delayed the spoilage of bream compared to control treatment. The experimental results indicated that chemical factors such as Total volatile nitrogen, pH, thiobarbituric acid and water loss significantly decreased in coating treatments (Song *et al*., 2010). Evaluation of physicochemical characteristics of packaged common Kilka by sodium alginate film was documented by Seifzadeh *et al* (2012). Lipids oxidation rate, chemical agents, Total volatile nitrogen, free fatty acid amount and thiobarbitoric acid assayed each month to end of experiment. According to the results warped fish fillets had a suitable quality until the end of storage period (Seifzadeh *et al*., 2012). Fujiwara *et al* (2013) described Alginate properties as effective film in combination with starch and chitosan. New finding showed that elongation at break and expandability of the collagen based film are significantly increased by addition of sodium alginate (Yang *et al*., 2014).

Carrageenan

The polysaccharide gum carrageenan, is a galactose polymer, Red seaweeds produce different kinds of sulfated polysaccharides, as carrageenans (*Chondrus crispus*) (Falshaw *et al*., 2005). With the experimental analyses Carrageenan was introduced an efficient film. Stoloff *et al* (1986) indicated coating fish fillets by dipping into carrageenan solutions (10 g/kg) prior to freezing and storing prevented any major sensory changes for up to 5 months, whereas controls treatments were found unacceptable after 3 months. Furthermore delay of destruction, until the seventh or eighth month of storage was demonstrated by adding antioxidants, Gallic acid or ascorbic acid to carrageenan coating solutions (Stoloff *et al*., 1986, Gennadios and Hanna, 1996). Aliabadi *et al* (2013) characterized biodegradable composite kappa-carrageenan films incorporated with *Satureja hortensis* essential oil on coating physical, chemical, barrier and antioxidant properties. The results explained carrageenan composite films were less resistant to breakage, more flexible and more opaque with lower gloss than the control treatment respectively. According to findings the films warped with essential oil showed excellent antioxidant, antibacterial and water vapor barrier properties the mechanical characters and vapor penetrance of starch/carrageenan coating were survived by Abdou *et al.*, (2014). Different concentrations of starch and carrageenan were mixed and the finding indicated the mechanical properties and vapor penetrance of the films increase with increasing carrageenan content (Abdou *et al.*, 2014).

Dextrans

Now the demand for environmentally biopolymers increased and has been focus of many researchers' efforts. Many efforts have been made to apply biopolymers to develop edible films coating. Dextran is microbial gums extracted from *Leuconostoc mesenteroides*and *Leuconostoc dextranicum* in nature. Dextran made of glucopyranosyl with modifying kinds of glycosidic unions (Issa Khan *et al.*, 2013). Dextran films proposed in the form of succulent solutions to preserve their aroma, taste, color and moisture during refrigerated period for coating seafoods and other meat products (Toulmin, 1956; Novak, 1957; Toulmin, 1957).

Microbial biofilms

Microbial polymers defined films gained by microbial production such as hydroxyalkanoates (PHAs) (Valdez *et al.*, 2014). Various microorganisms for example fungi, bacteria, algae and parasites can be warped into biofilms. Bacterial biofilms for example are applied in waste water treatment plants to help in cleaning water. Previous studies results indicated that microbial in biofilms can be adapted to detrimental conditions by altering their cellular functions. King (2002) demonstrated Biofilm bacterial cells have been found resistant to antimicrobials treatments, consist of antibiotics, surfactants or detergents, heavy metals and drying. Biofilm microbial are protected from negative influence with high tolerance to antibiotics (Brown *et al.*, 1988; Boyd and Chakrabarty, 1994; Beveridge *et al.*, 1997). Previous finding explained that chitosan has the advantage of being able to incorporate functional substances such as minerals or vitamins and possesses antibacterial activity As compared with other bio-based food packaging materials (Chen *et al.*, 2002; Jeon *et al.*, 2002; Moller *et al.*, 2004). According to new documented, Poly hydroxyalkanoates are a family of naturally occurring biopolymers which are produced by bacteria and are completely biodegradable (Corre, 2012). In watery conditions, bacteria recognize the nutrient source and consume it so changing PHA to biomass, water, vital gasses and monomers (Corre, 2012).

Conclusion

Recently, the uses of recyclable, renewable agricultural products for edible films were increased. Edible polymer plays a key role in food industrial now. The development of new technologies to improve the delivery properties of edible polymer was a major issue for future research. Now days, most studies on food shelf life focused on biofilms applications and food coating. seems, more researches be needed on biofilm usages in commercial scale with the purpose of providing more accurate information that can be applied to commercialize seafood products coated with edible polymers. Food industries were looking for edible biopolymers that could be used directly on seafood products and add nutrient value to their while increasing their shelf life.

Acknowledgements

We thank Fisheries Science Department, Gorgan University of Agricultural Sciences and Natural Resources for providing support for this research.

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