



A review of the applications of bioproteins in the preparation of biodegradable films and polymers

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ABSTRACT

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Environmental pollution due to the entry of synthetic polymers, plastics and non-degradable packaging materials into nature is one of the greatest dangers that threaten human life. Therefore, in recent years, the use of dietary proteins in the production of biodegradable films has intensified. Protein-based films have attracted a lot of attention because of their advantages, including their ability to be used in a variety of materials packaging. Protein films are used for small food packaging, especially special products such as beans, fruit kernels and cashews. Protein films can also be used to prevent spoilage and moisture migration in foods such as pizza, staples and candies. Protein films have good resistance to the passage of oxygen gas at low relative humidity and have good mechanical properties and turbidity. These films, like synthetic polymers, are used to package food, especially products that are individually packaged, such as beans, nuts, and peanuts. These films can be modified with antimicrobial and antioxidant agents to form bioactive films. Proteins such as corn husk, glutenin and gliadin, soy protein, gelatin, collagen, meat myofibril, milk casein, milk whey protein and egg protein are widely used in the production of biodegradable polymers. In this review article, we have tried to study the properties of protein polymers and their applications.

1. Introduction

Petroleum polymer films are widely used in the packaging industry due to their easy formability, cheap price, lightness, and high chemical resistance, variety of physical properties, heat-sealing capability, good printability and easy production process. In addition to their many benefits, these materials also have limitations. Pollution from these polymers such as burial, incineration and recycling has attracted the attention of researchers in recent years to using natural biodegradable polymers on the production of packaging materials [1, 2]. Biodegradable polymers not only consume less energy in the manufacturing process than existing plastics, but are also of particular importance because of their renewable consumables. The term biodegradable refers to the ability to break down the chemical structure of a substance into simpler substances such as carbon dioxide, water, methane, and biomass, which is due to the enzymatic activity of microorganisms [3, 4]. Biodegradable polymers due to the bonding of biodegradable functional groups such as ester and amide bonds in their chemical structure, after some time due to degradation processes, which are mainly aqueous or enzymatic hydrolysis, turn

into shorter and water-soluble polymers in water [5]. Environmentally friendly biopolymers are a good alternative to non-renewable and non-renewable packaging materials. In other words, biodegradable films are bio-polymeric materials that are prepared from natural and renewable sources and easily are decomposed by the metabolism of living organisms after consumption under suitable conditions of humidity, temperature, and presence of oxygen. They decompose naturally and no toxic or harmful substances remain in the environment [6]. Research on biopolymers suggests biodegradable alternatives to petroleum polymers. These polymers contain a variety of polysaccharides, proteins, fats and their combinations. Protein based polymers have been considered as suitable packaging materials with high potential and carriers for antimicrobial compounds [7-9]. Fig. 1 shows the degradation of biodegradable polymers during 80 days. Due to the renewable resources used in the production of these materials, the carbon dioxide produced during the destruction by plants is converted back into raw materials. This gas is consumed after a limited time by bacteria in the environment. Finally, these plastics do not remain in the form of waste piles in nature. In addition, a number of biodegradable biopolymers as

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