Polysaccharide-Based Edible Coatings for Plum

Subjects: Plant Sciences

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Polysaccharide-based edible coatings are served as an attractive preservation method for postharvest maintenance of most fruits. The current study examined the effect of carboxymethylcellulose (CMC)- and pectin (Pec)-based edible coatings on titratable acidity (TA), firmness; vitamin C (vit C); total soluble solids (TSS); pH; total phenolics; anthocyanin and flavonoid contents; total antioxidant capacity (based on 1,1-Diphenyl-2-picryl-hydrazyl hydrate (DPPH)); the activities of peroxidase (POD), polyphenol oxidase (PPO) and polygalacturonase (PG) enzymes; and weight loss during cold storage.

Keywords: Edible coating ; Quality improvement ; Cold storage

1. Introduction

Fruits and vegetables are a great source of antioxidants, anthocyanins, phenolics, some vitamins and nutritional elements [1] which are associated with a reduced risk of chronic health disorders [2][3]. Plums (*Prunus domestica* L.) are an important fruit, among the functional foods and nutraceuticals. Plums are a good source of antioxidants. They might help the human body to fight various diseases. However, plums have short postharvest life that results in the loss of valuable and nutritional elements [4]. Plums' quality rapidly declines after harvesting due to their high respiration rate. Consequently, after the transportation and marketing process, they often do not reach consumers at their best status [5][6].

2. History and Development

In recent years, applications of safer methods for fruit preservation are of high significance. These safe methods usually have neither side effects on human and animal health, nor negative influences on the environment. Edible coatings are considered as one of the safe strategies. Edible coatings could improve fruit postharvest. So, the application of edible coatings with natural origin such as proteins and polysaccharides has received a growing interest [7][8].

Polysaccharide-based edible coatings act as efficient oxygen blockers due to their well-arranged hydrogen-bonded network structure but not as moisture barriers. The coatings are commonly colorless, oil-free and with low caloric content that often prolong the postharvest storability of fruit by reducing the dehydration and oxidative rancidity [7]. Moreover, polysaccharide-based edible coatings are highly stable, safe, non-toxic and biodegradable. Cellulose derivatives and pectin are two main groups of polysaccharide-based edible coatings [9].

3. Carboxymethylcellulose (CMC)

Carboxymethylcellulose (CMC) is a cellulose derivative, anionic, linear, long-chain and high molecular weight compound [10][11]. CMC-based coatings mostly do not have odor, taste, and any toxic or allergic effects. They also are biodegradable, flexible, transparent, oil-resistant, soluble-in-water and slightly permeable to oxygen, CO_2, and moisture [12].

4. Pectin (Pec)

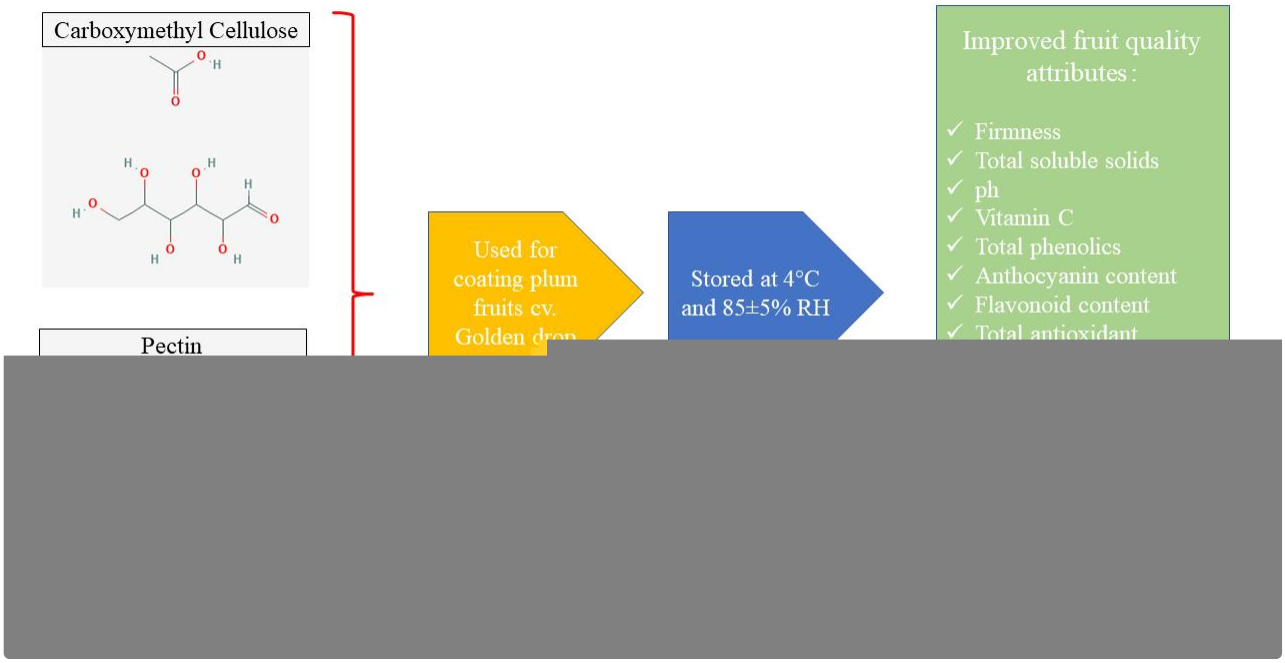
Pectin (Pec), the main compound of plant cell walls, is a complex high molecular weight polysaccharide with a branching structure [13][14], and an amorphous and colloidal carbohydrate [14]. Pec-based coatings are excellent barriers to O_2 and CO_2, in addition to their transparency, oil-resistance, and water solubility. They prevent moisture loss to some extent and eventually maintain the sensory aspects and quality of foods [14][15].

CMC-based edible coatings have been shown to be efficient in preserving the postharvest quality of pear, papaya, mandarin and peach [16][17][18][19]. Pec-based ones preserved the quality of peach, nectarine, fresh-cut apple, and persimmon [20][21][22][23]. Some studies reported the application of edible coatings on plum fruit, including chitosan [24], and carboxymethylcellulose, alone [8] or in combination with irradiation [6].

Given this background, few studies were performed using these polysaccharide-based edible coatings (CMC and Pec) on plum fruit during cold storage. CMC-based edible coatings (with the best effect at 1%) were effective in maintaining the firmness and nutritional attributes (e.g., titratable acidity (TA), vitamin C (vit C), anthocyanin, flavonoid, antioxidant activity), decreasing polyphenol oxidase (PPO) and polygalacturonase (PG) and increasing peroxidase (POD) enzymes activities in plum during shelf life [8]. Moreover, no report of any combination of the two coatings was observed on plum fruit. Accordingly, this study aims to investigate the influence of CMC- and Pec-based edible coatings, alone and combined, on some postharvest qualitative and enzymatic activities of plum in order to reduce postharvest losses of this fruit. Furthermore, the current survey might be a comprehensive evaluation of different qualitative characters especially antioxidant contents and enzymatic behavior of coated plum during cold storage.

5. Conclusions

The current survey reported positive effects of CMC- and Pec-based edible coatings, either alone or in combination with each other, on plum fruit through cold storage in terms of the measured parameters, except weight loss. The coatings especially improved vit C, total phenolics, anthocyanins and flavonoids contents and POD enzyme activity and decreased PPO and PG enzymes activities. CMC at 1% and Pec at 1.5% demonstrated the best results. Additionally, 0.5% Pec + 1.5% CMC is a good combined formulation for the preservation of the nutritional value of plum during postharvest. Thus, the application of CMC and/or Pec and/or their combinations might be considered as a favorable and safe coating approach for extending and improving postharvest qualitative characteristics of plum fruit.



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