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Bioedible coating of meat using garlic, cinnamon and turmeric

Madhumita Rakshit, C. Ramalingam*, Divyakriti Yogeshwar and Jasmine Bedi

School of Bioscience and Technology (SBST), VIT University, Vellore, Tamil Nadu,

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ABSTRACT

Garlic, cinnamon and turmeric are found to have natural antimicrobial properties. As these spices are used for preparing food items, it acts as an enhancer in taste as well. Utilising these properties, coating of protein rich food items was done with garlic and cinnamon aqueous paste and extract with range of 0.08g to 0.16 g/g of solid food product. The efficiency of three different binding agents namely, agar, corn-flour and gum Arabic was tested. Because of the bio-edible coating, a modified atmosphere is created which slows down the growth of microbial flora. The paste of Garlic and Cinnamon with Gum Arabic as the binding agent has been found to show maximum increase in shelf life.

Key words: Bio-edible coating, shelf life, antimicrobial properties, modified atmosphere, Garlic, Cinnamon, Turmeric

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INTRODUCTION

Bio edible coatings are thin layer of edible materials applied to food products that play an important role in their conservation, distribution and marketing. They can be used for highly perishable protein rich food products like meat and mushroom for protecting them from mechanical damage, physical, chemical and microbiological activities. Oxygen is responsible for degradation processes mainly because it causes oxidation of fats and accelerates the consumption of sugars and other compounds thus increasing ethylene production and causing senescence [1, 2]. These coatings acts as an envelope and create a modified atmosphere restricting the transfer of gasses (O_2,CO_2) and also becoming a barrier for aromatic compounds,thus preventing quality changes in food[3]. The edible coating formulations must wet and spread uniformly on the surface of food product and after drying a coating that has adequate adhesion, cohesion and durability to function properly must be formed [4]. Polysaccharide matrices are able to encapsulate aroma compounds in order to maintain the organoleptic quality in food systems [5]. A major advantage of using these is that we can incorporate many active ingredients into the polysaccharide matrix which can be thus consumed with food thereby enhancing safety and nutritional and sensory attributes.

Indian food comprises of addition of lots of spices in order to enhance taste. Spices like garlic (*Aliumsativum.L)* hold an important value due to its prophylactic and therapeutic actions. Sulphur and polyphenols present in garlic respond to the antibacterial,antifungal and antioxidant activity[6].Garlic has been described to exhibit antimicrobial activity [7,8,9], antitumor activity [10,11], as well as antithrombotic, antiarthritic, hypolipidemic, and hypoglycemic activities [12,13]. *Cinnamomumzeylanicum (L.)*, commonly known as cinnamon is rich in cinnamaldehyde as well as b-caryophyllene, linalool and other terpenes. Cinnamaldehyde is the major constituent of cinnamon leaf oil and provides the distinctive odour and flavour associated with cinnamon.It is used worldwide as a food additive and flavouring agent and it is listed as GRAS[15]. It has been found out that Cinnamaldehyde and Eugenol inhibit production of an essential enzyme by the bacteria and/or cause damage to the cell wall of bacteria [16]. Turmeric has long been used as a colouring and flavouring agent for foods. Curcuminoids are the main component of turmeric

and have a range of pharmacological activities [17]. In our previous study it has already been proved that the same coating with different concentration of garlic and cinnamon extract was even able to preserve fish [14].

Agar is a polymer made up of subunits of the sugar galactose which can be used as a laxative, a vegetarian gelatin substitute, a thickener for soups, in fruit preserves, ice cream, and other desserts, as a clarifying agent in brewing, and for sizing paper and fabrics. Corn-flour or maize starch is the starch of the corn (maize) grain obtained from the endosperm of the corn kernel.It is used as a thickening agent in soups and liquid-based foods, such as sauces, gravies and custard. As the starch is heated, the molecular chains unravel, allowing them to collide with other starch chains to form a mesh, thickening the liquid (Starch gelatinization).Gum Arabic (GA) is a branched-chain, complex polysaccharide, either neutral or slightly acidic, found as a mixed calcium, magnesium and potassium salt of a polysaccharidic acid. The backbone is composed of 1, 3-linked b-D-galactopyranosyl units. The side chains are composed of two to five 1,3-linked b-D-galactopyranosyl units, joined to the main chain by 1,6-linkages.GA has wide industrial uses as a stabilizer, thickening agent and emulsifier, mainly in the food industry (e.g. in soft drinks syrup,gummy candies andmarshmallows), but also in the textile, pottery,lithography, cosmetics and pharmaceutical industries [18]

MATERIALS AND METHODS

Material acquisition
Corn-flour, Garlic, Cinnamon and turmeric were bought from the local supermarket. Gum Arabic was purchased from RALAXY. The Hot air oven used is from The ILE Co. And programmable environmental test chamber from REMI is used for incubation.

2.1 Preparation of extract
20 g of Garlic and Cinnamon were grinded in grinder individually. 25 ml of sterile water is added to each of these.2g freshly grinded turmeric was taken and mixed with 4 ml of sterile water. Each of these was kept overnight. Next day extract was collected by filtering it though Whattman's filter paper no. 1.

2.2 Preparation of paste
Various concentrations were tested for their efficacy in reducing the microbial load. The concentrations taken were 1g, 2g and 3g of Garlic and cinnamon together and turmeric separately. For preparation of paste the grinded mixture is mashed further using pestle and mortar and a small amount of water is added.

2.3 Preparation of coating
Three different binding materials used were Agar, Corn-flour and Gum Arabic. All three were individually checked for their binding properties. 0.1 g Agar was taken in 10ml of sterile water and heated till it formed a clear liquid. 0.5 g Corn-flour was taken in 20 ml of sterile water and heated to form a sticky solution. 4g Gum Arabic in 2ml sterile water was taken. These coatings are appropriate for 8 g of meat. Garlic and Cinnamon are mixed properly with the coatings according to the weights mentioned above. Coating of these three materials with turmeric was prepared separately. The pieces were dipped and properly coated, with the coating prepared using sterile forceps and kept in hot air oven at 60^0C for 1 hour. The pieces were then taken out and put in sealable plastic pouches and kept in incubator at 35^0C.

2.4 Day wise and Hourly study on shelf life of the coated and uncoated product with extract and paste. Nutrient Agar plates were made and the coated meat pieces kept in the environmental chamber were used. A sterile loop is taken and dabbed slightly on the coated piecesand streaking was done .This procedure is carried out for 7 days till microbial load starts increasing.

For hourly studies the coated meat pieces were dipped in 10 ml sterile water and serially diluted to 10^{-3} dilutions for 0^{th} hour. The same procedure was followed for uncoated meat piece which was used as a control. For the 3^{rd}, 6^{th} and 9^{th} hour uncoated piece was diluted to 10^{-7} dilutions while the same dilutions were kept for garlic and cinnamon coated pieces, the 9^{th} hour turmeric coating was diluted to 10^{-4} dilutions.

RESULTS AND DISCUSSION

Day wise study on shelf life
The results obtained for day wise study indicated that the paste was better than the extract. This can be attributed to the fact that the antimicrobial constituents are in more concentrated form in paste than in extract.

DAYS	GRAMS OF MEAT PIECES	CORNFLOUR		CORNFLOUR	
		G+C extract	T extract	G+C paste	T paste
0	0.5	-	-	-	-
	1.0	-	-	-	-
1	0.5	+	+	+	+
	1.0	-	+	-	+
2	0.5	-	+	-	+
	1.0	+	++	-	+
3	0.5	+	+	+	+
	1.0	+	+	-	+

Table 1: Microbial growth with corn-flour coating

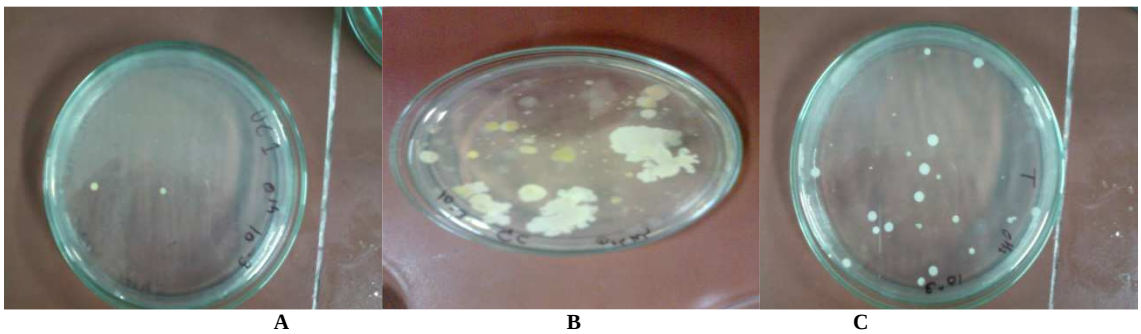
DAYS	GRAMS OF MEAT PIECES	AGAR		AGAR	
		G+C extract	T extract	G+C paste	T paste
0	0.5	-	-	-	-
	1.0	+	+	+	-
1	0.5	+	+	+	+
	1.0	-	+	+	+
2	0.5	-	+	+	+
	1.0	+	++	-	+
3	0.5	+	+	+	+
	1.0	+	+	-	+

Table 2: Microbial growth with Agar coating: + (Growth) ;++ (High Growth);- (Reduced Growth)

Fig.1. Hourly study for meat using Gum Arabic

The results corroborate the fact that garlic and cinnamon have lead to a decrease in microbial load, while turmeric had an increase in the count. The uncoated piece which was used as a control showed an exponential increase in the count.

0th Hour



A **B** **C**

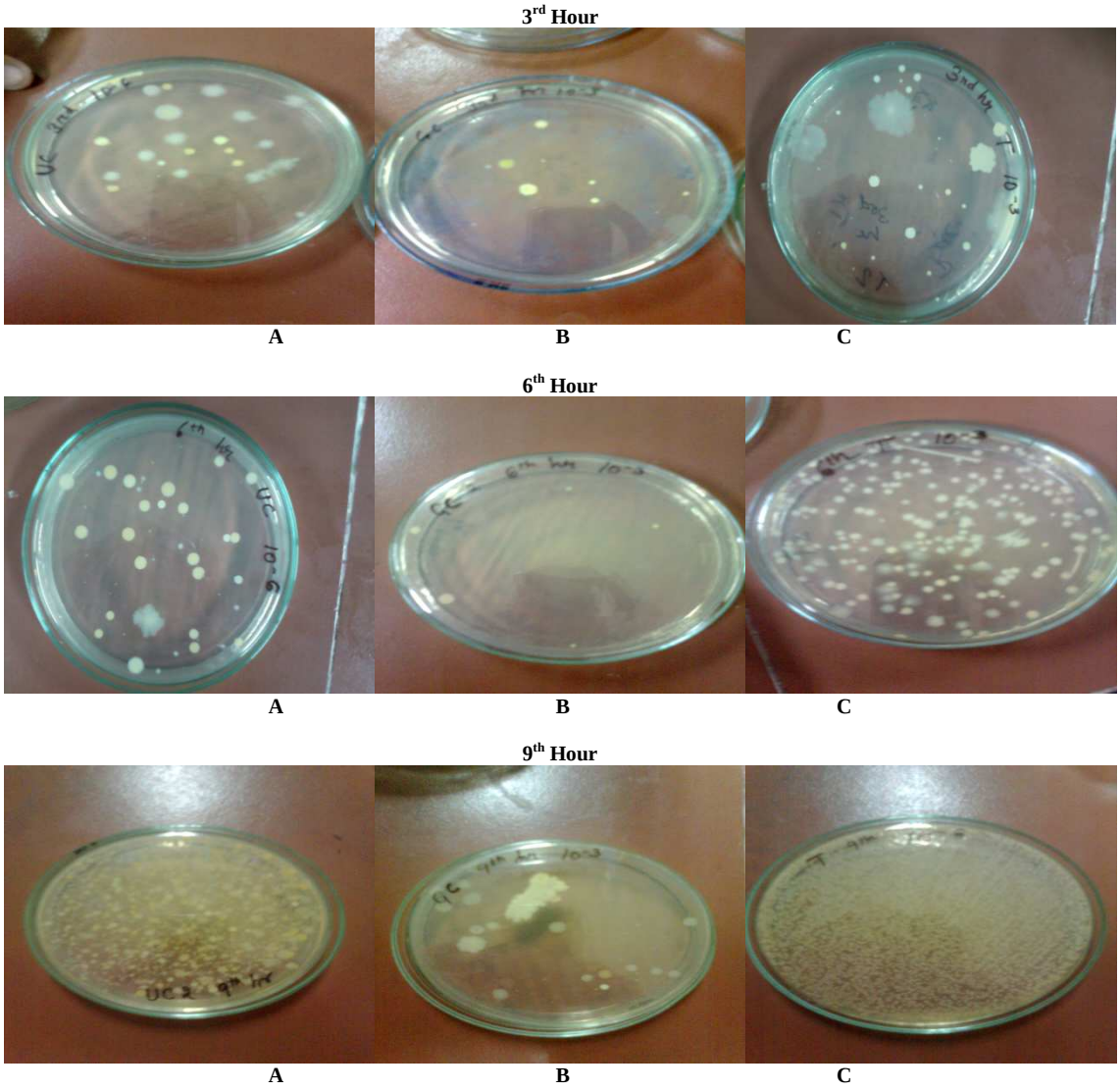


Fig.2. A, B and C denote uncoated, garlic and cinnamon coating and turmeric coating respectively

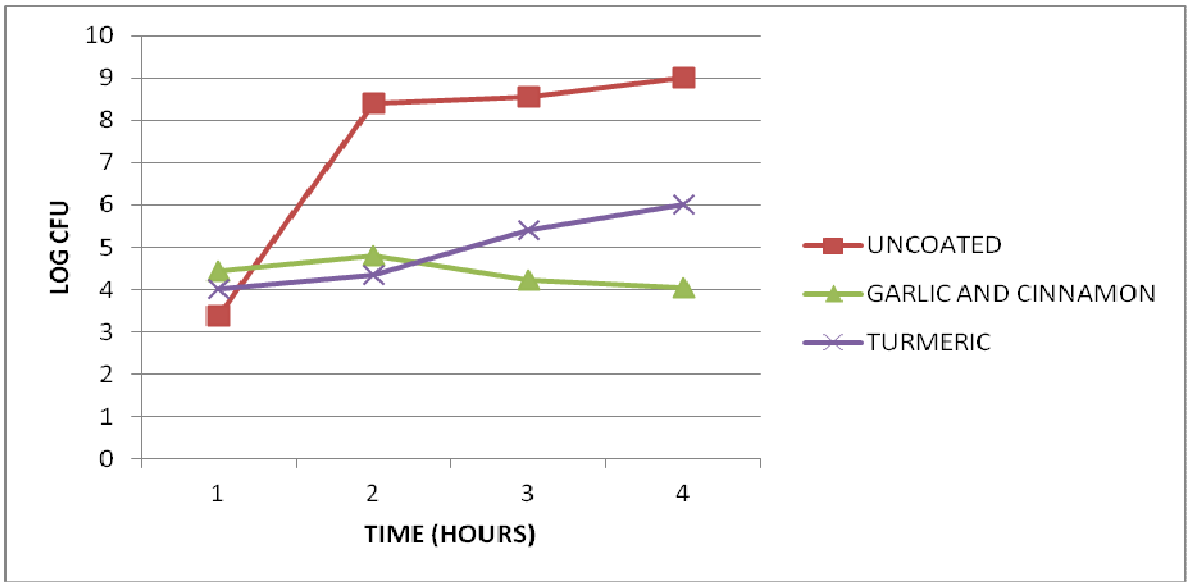


Fig.3. Graph representing log values of Colony Forming Units (CFU) with respect to time

CONCLUSION

Since garlic cinnamon and turmeric are commonly used in households for cooking, they serve as a cheap and effective method of preserving and increasing shelf life. From the results we can conclude that the age old use of turmeric as an antimicrobial agent falls in efficacy when compared to garlic and cinnamon. These results most likely reflect the ability of coating to act as a barrier to the gaseous exchange and microbial growth.Various other binding agents can also be tried for their efficiency. The same work can be tried upon on other products like mushroom which is high in protein content and perishable.

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