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Application of Chitosan in Food Preservation

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Abstract: ***In the present investigation, chitosan from prawn shell waste was analysed for its preservative potential in vegetables. Studies have been carried out to determine the aging and textural changes in Brinjal, Capsicum and Tomato under the effect of chitosan treatment. After the experimental exposure, the control vegetables have turned soft in texture whereas no such changes have been observed in the chitosan sprayed vegetables even at the end of 8th day of observation. Chitosan caused delayed ripening and reduced decay incidence. Thus chitosan can be used as a potential preservative for agricultural products.***

Keywords: Chitosan, Preservative potential, Brinjal, Capsicum and Tomato

1. Introduction

The postharvest loss of many fruits and vegetables is due to their perishable nature. During storage and transport, they undergo fungal infection, physiological disorders and physical injuries.

Many such post harvest produce are kept in moderately low temperatures and high humidity. However commodities such as tomatoes undergo chilling injury [1]. Atmospheric modification with low O_2 and CO_2 is carried out as an alternative method to prolong the shelf life [2]. It can be done through plastic film packaging and by individual coating with wax, sucrose fatty esters [3], [4].

Among the promising approaches for inducing plant disease resistance and stimulate the immunity of plant to increase its shelf life is Chitosan [5]. Chitosan, obtained by deacetylation of Chitin, might be an ideal preservative coating for fresh fruits and vegetables because of its film-forming and biochemical properties [6].

Chitosan is natural polysaccharides, which consists of a copolymer of N-acetyl-D-glucosamine and D-glucosamine residues linked by β-1, 4 glycosidic bonds [7].

Furthermore, Chitosan is considered to be a safe material as indicated by toxicological studies [8]. Hence, this substance has potential as a post harvest coating material in food preservation.

Earlier, the effect of Chitosan has been studied for the inhibition of sclerotinia rot of carrots [9]. Its effect on strawberries [10], peas [11], tomatoes [10] and cucumber [12] has been studied.

The objective of this paper was to determine the effect of Chitosan on the aging of Brinjal, Capsicum and Tomato over a period of 8 days.

2. Materials and Methods

Chitosan solutions were prepared by dissolving Chitosan (1% & 3 % (w/v)) in 0.25N HCl. The solution was centrifuged to remove undissolved particles and the pH was adjusted to 5.6 with 1N NaOH. At this pH, Chitosan is positively charged and exhibits maximal biological activity [13].

The samples namely brinjal, capsicum and tomato were taken. The vegetable samples were coated with 1 % and 3% Chitosan solution. Control sample was kept without any coating on the surface. The vegetables were monitored carefully for the effect of Chitosan.

3. Results and Discussions

Table 1: Effect of Chitosan on Brinjal

S.No	Day	Control	1 % Chitosan	3 % Chitosan
1	First Day	No Change	No Change	No Change
2	Second Day	No Change	No Change	No Change
3	Third Day	Wrinkles were formed	No Change	No Change
4	Fourth Day	Wrinkles were formed	No Change	No Change
5	Fifth Day	Deep wrinkles were formed	No Change	No Change
6	Sixth Day	Wrinkles have been developed more deeply	No Change	No Change
7	Seventh Day	Soft in texture, deep wrinkles and size began to shrink	No significant changes observed	No Change
8	Eighth Day	Deep wrinkles, size shrunk	No significant changes observed	No Change

It is observed from the results that over the span of 8 days, the signs of aging have appeared in the control whereas no such changes have been seen in both the Chitosan sprayed brinjal.

Table 2: Effect of Chitosan on Capsicum

S.No.	Day	Control	1 % Chitosan	3 % Chitosan
1	First Day	No Change	No Change	No Change
2	Second Day	Wrinkles have started to appear	No Change	No Change
3	Third Day	Wrinkles have formed	No Change	No Change
4	Fourth Day	Wrinkles were formed and size began to	No Change	No Change

		shrink		
5	Fifth Day	Size has shrunken significantly, wrinkles have developed	Very small wrinkles start to appear	No Change
6	Sixth Day	Has turned soft, well developed wrinkles and colour began to deteriorate, size has shrunken.	Small wrinkles remains same	No Change
7	Seventh Day	Size began to shrink severely soft, wrinkles texture appeared	Wrinkles have appeared	Small wrinkles started to appear
8	Eighth Day	Size was shrunken well and wrinkles were very deep	Wrinkles have appeared	Wrinkles have appeared

It can be observed that the aging process of the control fruit on begun on the second day with the formation of wrinkles whereas on the capsicum with 1% Chitosan, wrinkles begin to appear only on the fifth day. 3% Chitosan sprayed capsicum shows wrinkle formation only on the seventh day. At the end of the eighth day, the control has completely aged while the Chitosan sprayed capsicums appear with wrinkles.

Table 3: Effect of Chitosan on Tomato

S.No.	Day	Control	1 % Chitosan	3 % Chitosan
1	First Day	No Change	No Change	No Change
2	Second Day	No Change	No Change	No Change
3	Third Day	No Change	No Change	No Change
4	Fourth Day	No Change	No Change	No change
5	Fifth Day	No Change	No Change	No change
6	Sixth Day	Has started to turn soft	No Change	No change
7	Seventh Day	Soft in texture	No Change	No change
8	Eight Day	Soft in texture	No Change	No change

It can be observed that at the end of eighth day of observation, the control has turned soft in texture whereas no such changes have been observed in the Chitosan sprayed tomatoes.

BRINJAL

Figure 1: Day 1

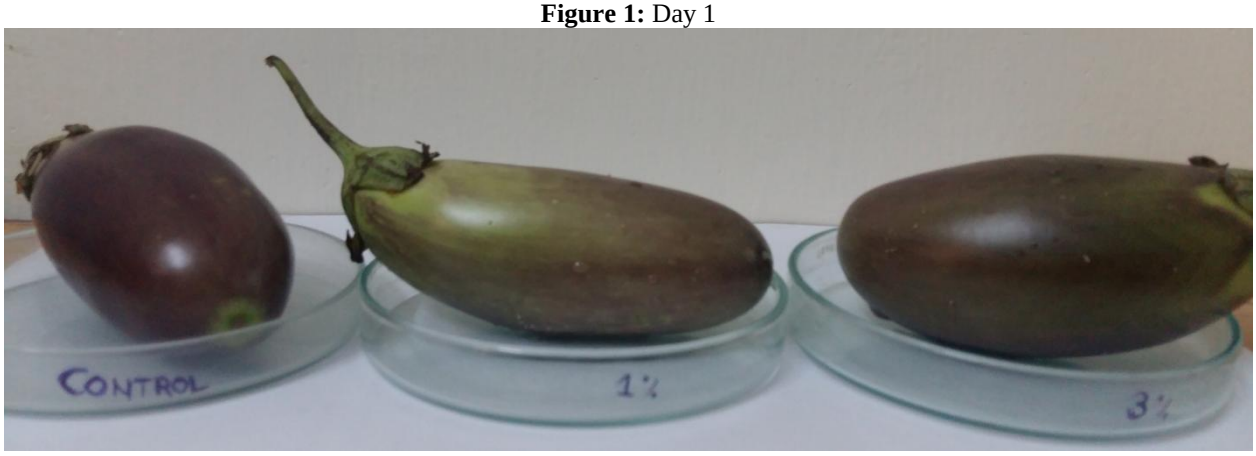


Figure 2: Day 2

Figure 3: Day 3

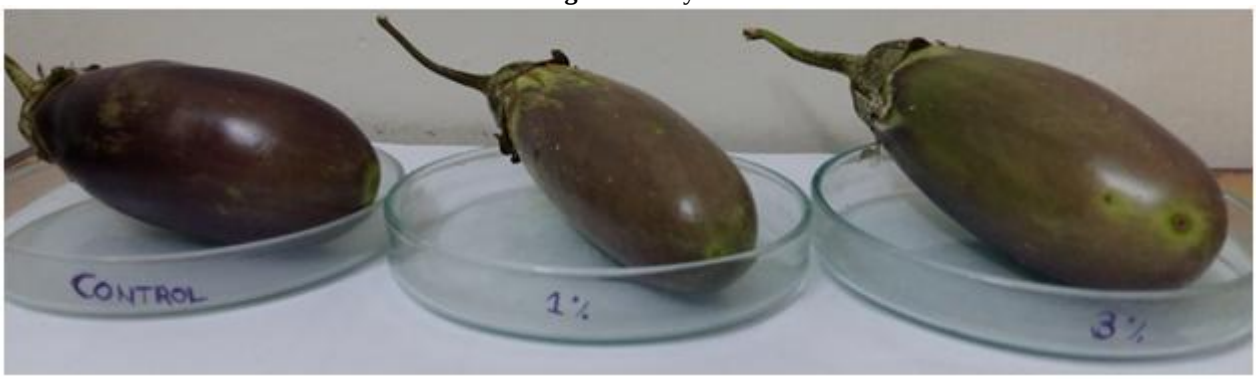


Figure 4: Day 4

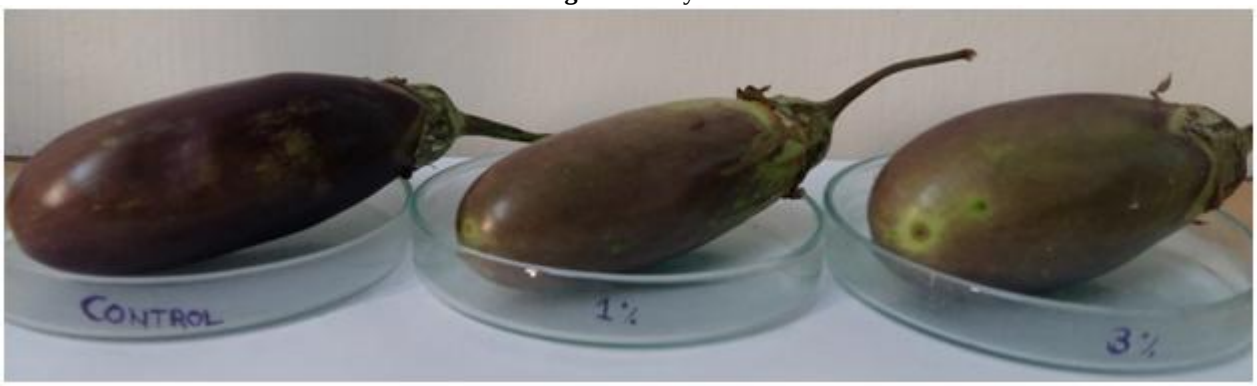


Figure 5: Day 5

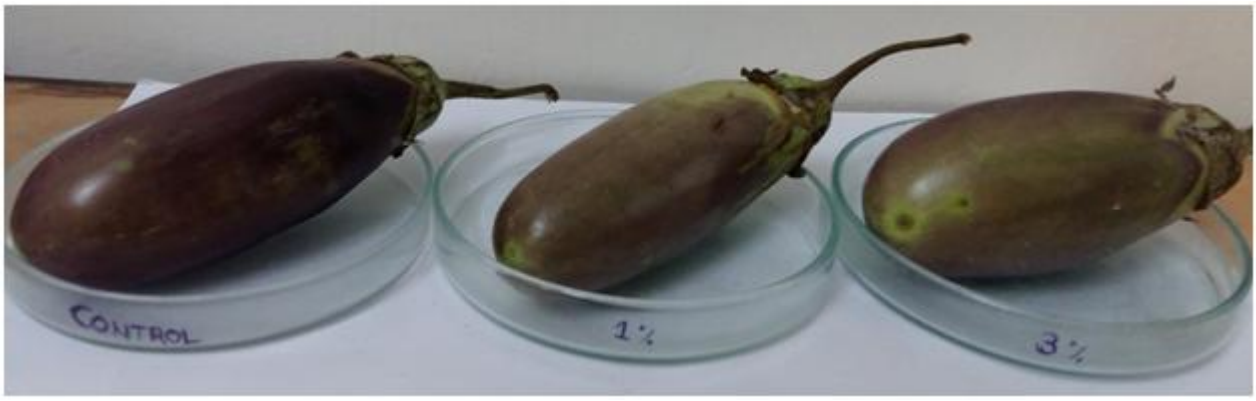


Figure 6: Day 6

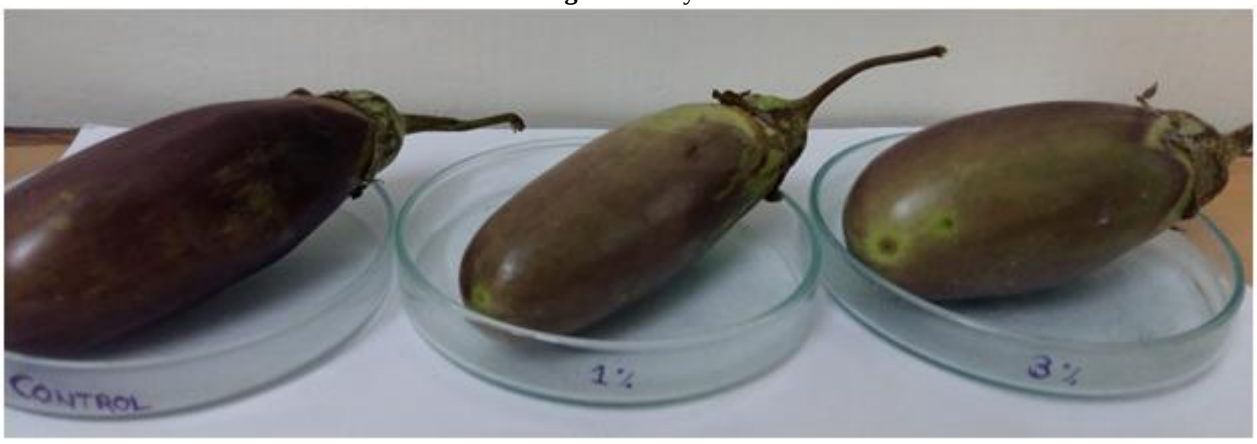


Figure 7: Day 7

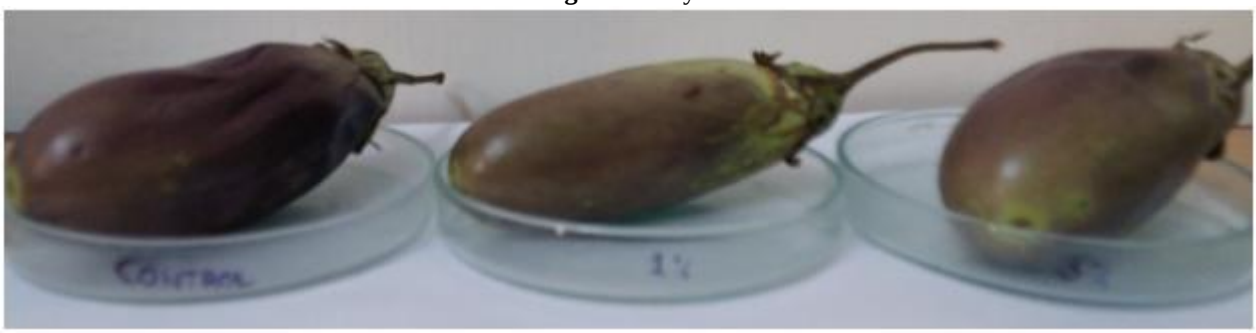


Figure 8: Day 8

CAPSICUM

Figure 9: Day 1

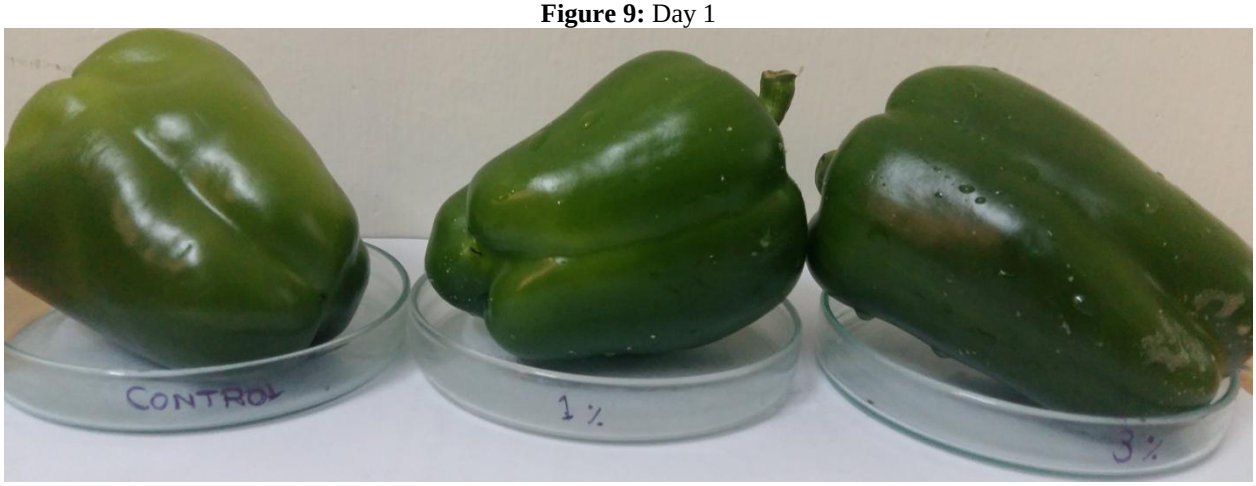


Figure 10: Day 2

Figure 11: Day 3

Figure 12: Day 4

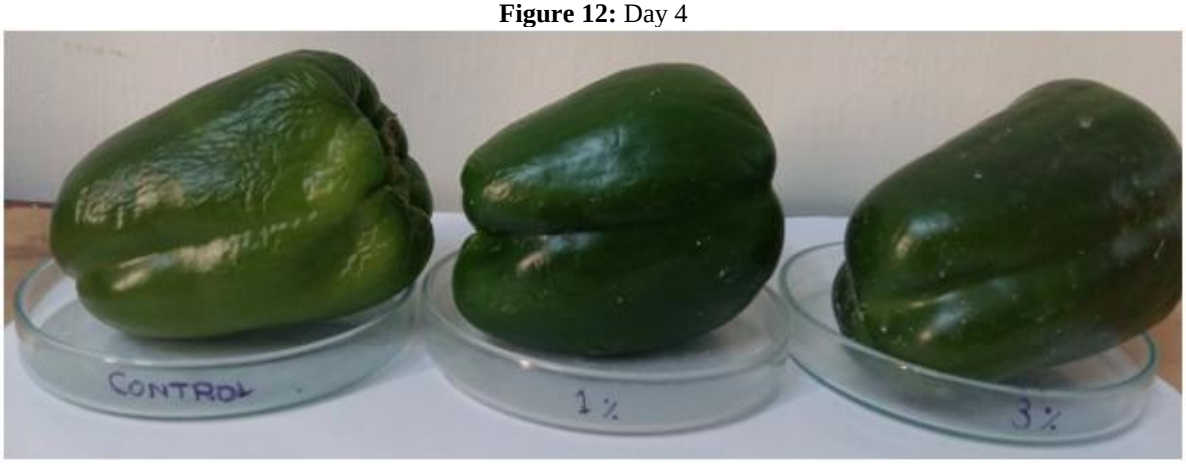


Figure 13: Day 5

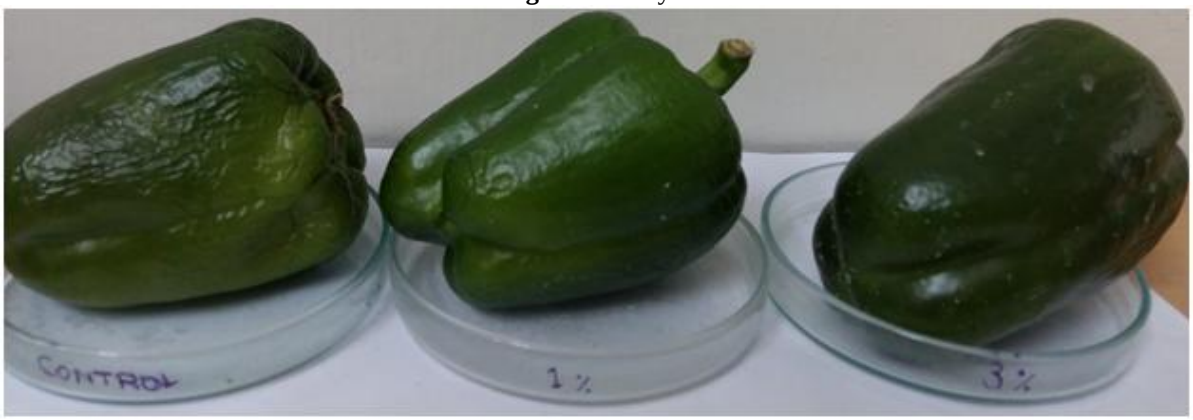


Figure 14: Day 6

Figure 15: Day 7

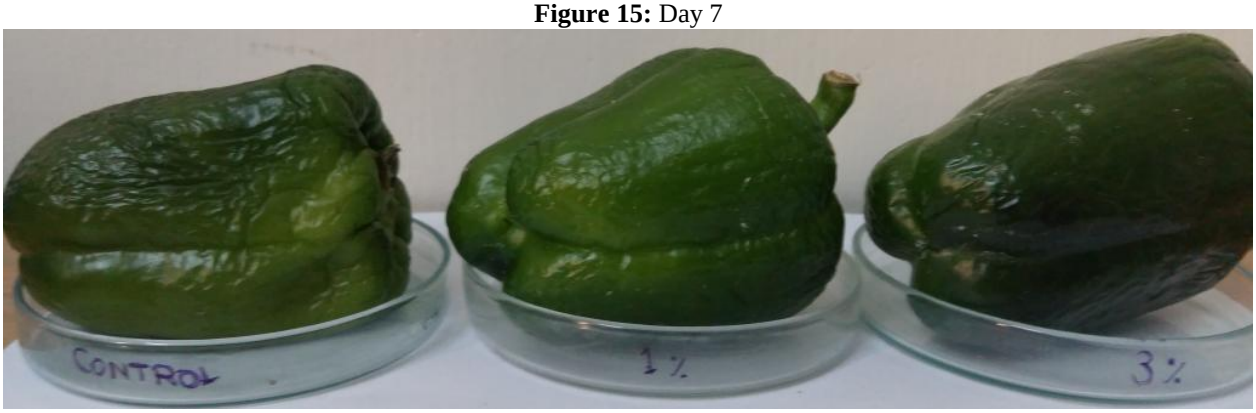


Figure 16: Day 8

TOMATO

Figure 17: Day 1

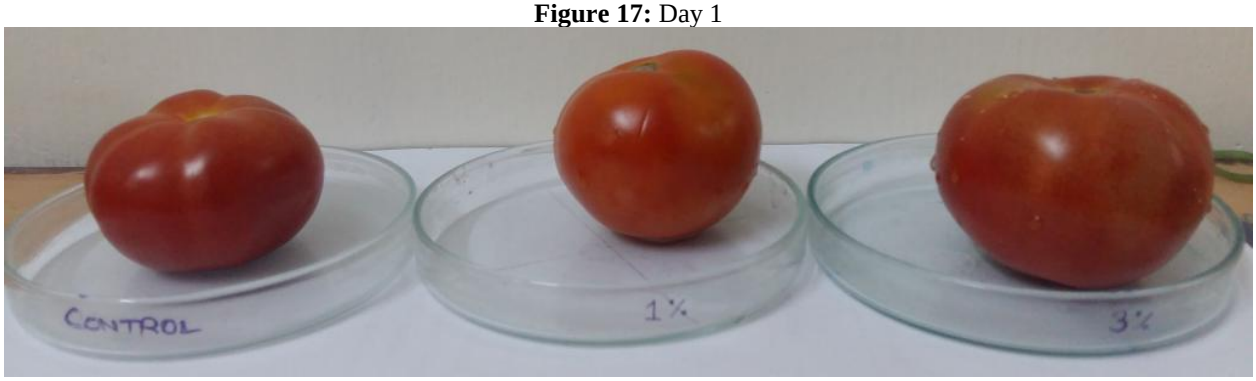


Figure 18: Day 2

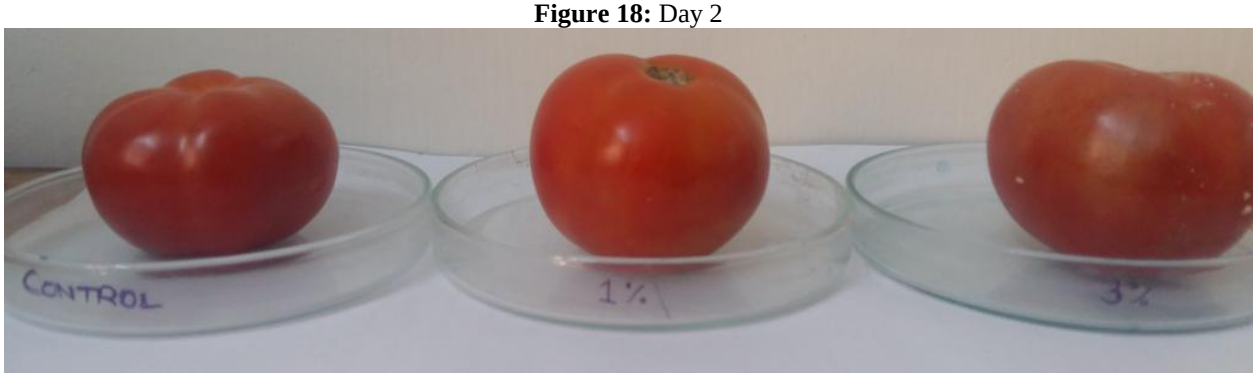


Figure 19: Day 3

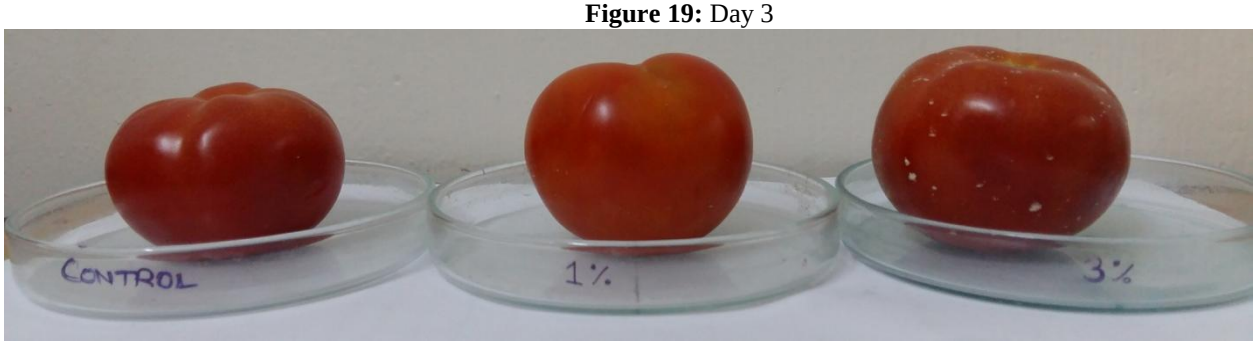


Figure 20: Day 4

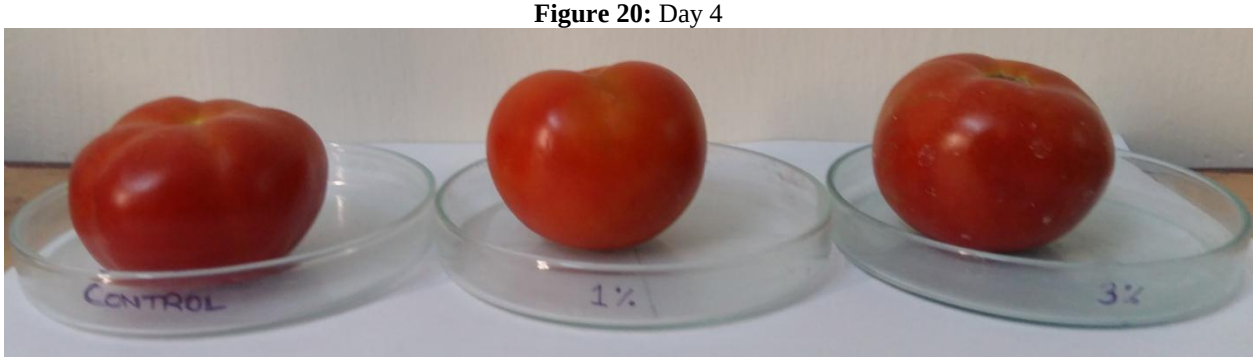


Figure 21: Day 5

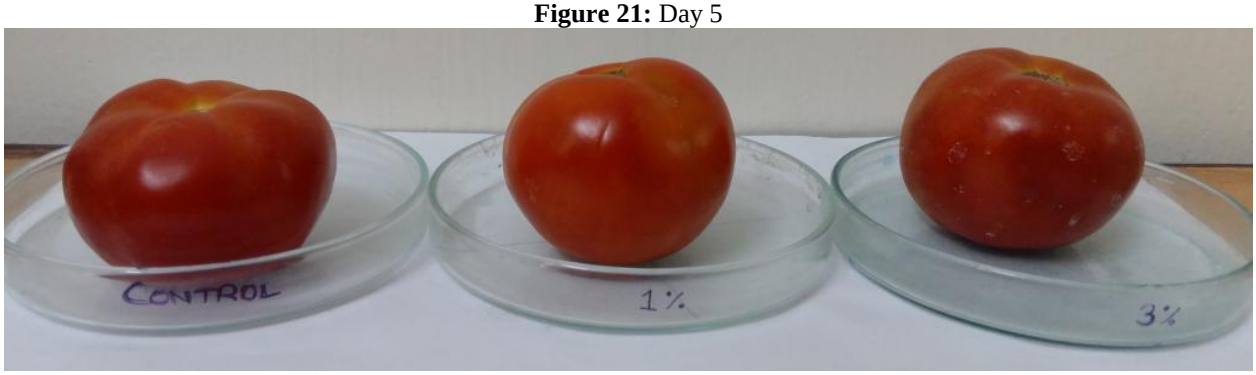


Figure 22: Day 6

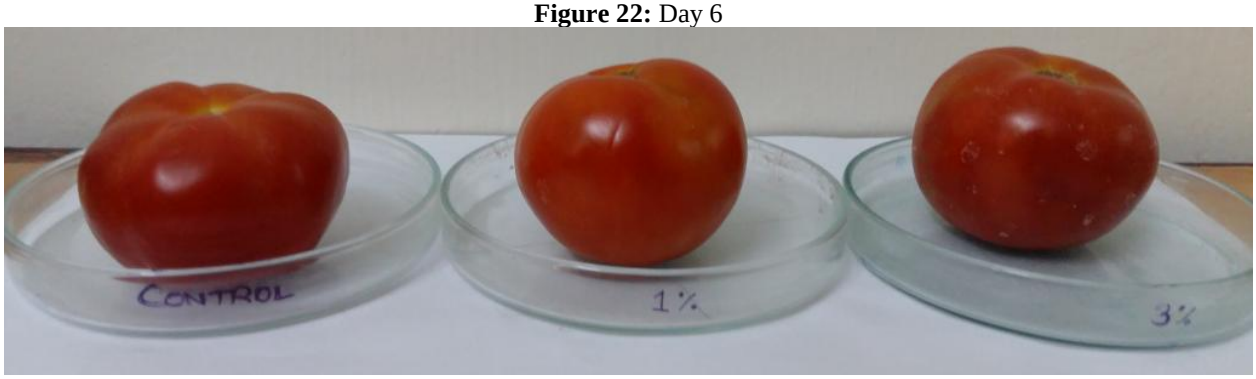


Figure 23: Day 7

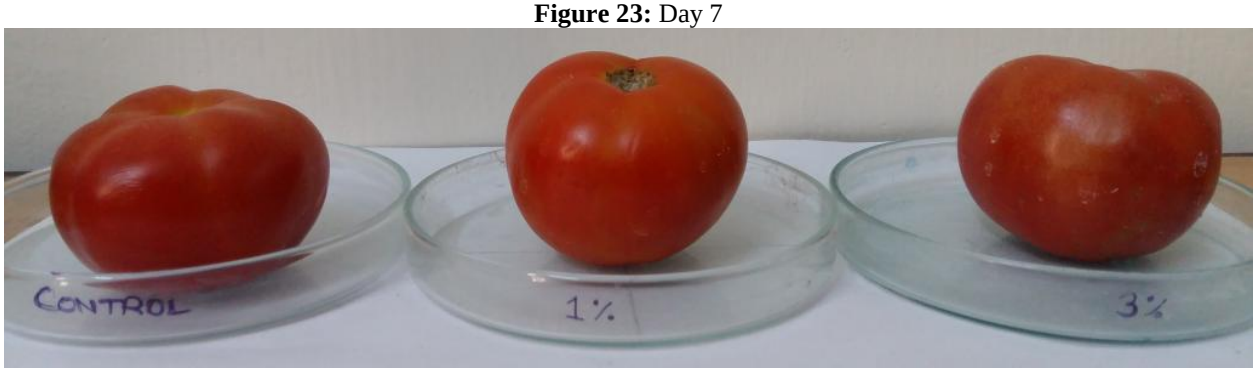
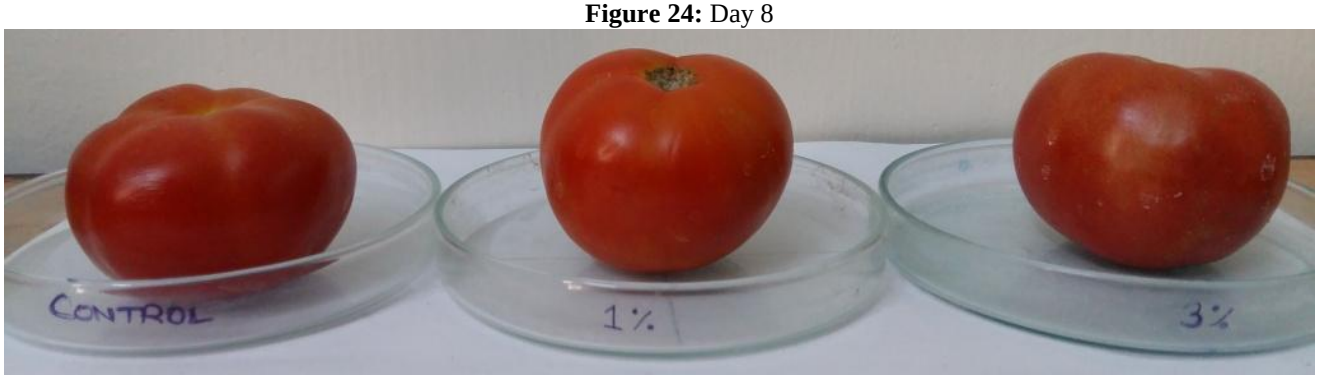


Figure 24: Day 8



It can be inferred from the above results that the Chitosan coating on the tomatoes, brinjal and capsicum delayed the signs of aging namely, formation

Ghaouth (1992) [10] studied the effect of Chitosan coating on the storage life of tomatoes and observed that Chitosan derived coatings delayed ripening and reduced decay incidence in tomato fruit. Ghaouth (1992) [10] also carried out similar studies on cucumber and bell pepper fruits to analyse the effect of Chitosan coating on water loss and quality maintanence. It was observed that Chitosan was a potential preservative as it reduced the weight loss and improved the appearance. The results of this study were found to be in accordance with it. However, there has been no previous work of this nature carried out on brinjal.

Thus from this study, it can be concluded that the spraying of Chitosan on tomato, capsicum and brinjal has delayed the signs of aging namely, formation of wrinkles, softening of the skin texture, reduction in weight and sometimes change in colour. It is also notable that higher percentage of Chitosan (3%) has not had any significant difference than the lower percentage of Chitosan (%1). Hence Chitosan at lower percentage can be used for food preservation.

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