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# EFFECTS OF NEEM SEED KERNEL *(AZADIRACHTIN INDICA A. JUSS)* EXTRACTS AND CHITOSAN ON THE STORAGE OF CUCUMBER *(CUCUMMIS SATIVUS)*

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**Keywords:**

*Azadirachtin indica*, *Cucumis sativus*, chitosan

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## ABSTRACT

The purpose of this study was to determine the effects of neem seed extract *(Azadirachtin indica)* combined with chitosan on the shelf - life and quality of cucumber *(Cucumis sativus)*. Three levels of neem seed aqueous (90g/l, 120g/l 150g/l) and three levels of chitosan (1%, 1.5%, 2%) were used in this experiments. Cucumbers were immersed in the neem seed extract first, then coated with chitosan and stored at $25^0$C. The result was showed that cucumber treated with neem seed extract significantly delayed the increase of fungal decay, especially at the level of 120g/l. Treated with 2% chitosan showed the maximum effect in controlling the loss of weight, decreased the titratable acidity and slowly increased the total sugar content in fruits. After 7 days of storage, the combination of 120g/l neem seed extract and 2% chitosan was the most effective method compared to the other treatments.

## INTRODUCTION

Cucumber is a popular fruit used in making a wide variety of dishes. Cucumber has a high water content of approximately 90%. It also contains an impressive percentage of vitamin A and C which bring many benefits for human health. In Vietnam, cucumber is widely cultivated, especially in the North. According to a report of the production of cucumber and tomato in Vietnam (Thi et al., 2008), the total quality of cucumber harvested annually reached approximately 100.000 tons. Cucumber makes up the most of vegetables products for export (Thi et al.,). Chitosan is obtained by the reaction of chitin deacetyl (Tolamite et al., 2000). Chitosan has been proved to be very effective in fruit preservation due to its rapid nature protection, anti-dehydration, antibacterial and antifungal. The effects of chitosan used as a postharvest coating of cucumbers to reduce water loss and maintain their quality was shown in a report of El - Ghaouth (1991). Neem tree *(Azadirachta Indica*) contains a variety of complex compounds that are very well known for their ability of antifungal and antibacterial. Among them, azadirachtin is considered to be one of the most important compounds. Azadirachtin is widely used as a skin treatment or pesticide in the world. However, there are a few studies done on determining the effects of azadirachtin on fruit preservation.

The aim of this study is to investigate the effects of neem seed extract in combination with chitosan on controlling the postharvest diseases of cucumber.

## MATERIALS AND METHODS

### Materials

Cucumbers were brought from Da Lat province and then transported to Ho Chi Minh City. Cucumbers were sorted based on the dark green color skin of fruit uniform size and shape

Neem seeds have removed the pulp, dried at temperatures $<50^0$C, derived from the neem tree over 4 years in Ninh Thuan.

Chitosan is obtained from the University of Nha Trang, Vietnam, with the following criteria: color: white light, moisture 10.5%, ash 0.98%, protein: 1.01%, viscosity (cps): 838, the acetylated: 86.4%, solubility: 99.1%, opacity: 2.21

### Preparation of Neem seed kernels extract and chitosan

Neem seed kernels were prepared by grinding and sieving then soaked in ethanol $96^0$. The concentration of neem kernel extracts used in this study, respectively 90g, 120g, 150g of neem seseds kernels/ l ethanol.

Chitosan was dissolved in 1% acetic acid and then shaken in 30 rpm / min for 24 hours. The concentrations of chitosan used in this study were 1.5%, 2%, 2.5%.

**Coating application**

Cucumbers were embedded in a solution of neem first and then in chitosan solution.

**EXPERIMENTAL LAYOUT**

The nine combinations of neem kernel extract and chitosan.

**Table 1. Experimental layout**

| Neem/Chitosan | 1.5% | 2.0% | 2.5% |
|---|---|---|---|
| 90g/l | N1C1 | N1C2 | N1C3 |
| 120g/l | N2C1 | N2C2 | N2C3 |
| 150g/l | N3C1 | N3C2 | N3C3 |

**Quality analyses**

*Weight loss:* using electronic scales, the mass loss rate based on the volume of the preservation process results over the volumes initially.

*Titrable acidity:* using 0.1N NaOH, phenolphatalein 0.1% as an indicator with a pH meter, stop the titration when the pH is show about 8.2.

*Reducing sugars:* using 0.5% glucose solution and the mixture of Fehling A and B. When the mixture of Fehling reaction medium, sugars will discoloration of methylene blue indicator, which is the end of the reaction.

Statistical analysis of the results was performed using a one-way analysis of variance (ANOVA). The Microsoft Excel software was used.

**RESULTS AND DISCUSSION**

**Weight loss**

The weight loss of all samples increased (Figure 1). The samples coated with 2% chitosan and 2.5% at any concentration of neem kernels extracts showed the lowest loss of weight. The using of chitosan at higher concentration showed a better effect than other samples. This result is in agreement with Jiang et al (2001) on longan, Pilar Hernandez-Munoz et al (2008) on strawberry.

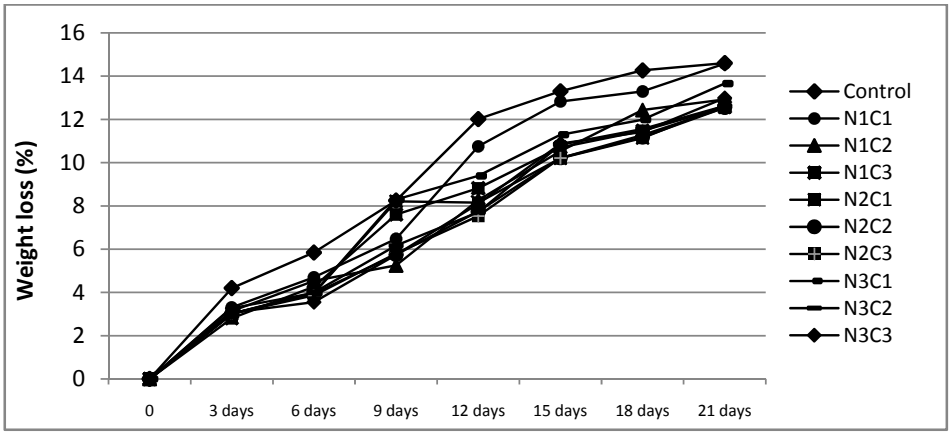


***Figure 1. Weight loss of cucumber on the storage***

**Reducing sugars**

During the ripening process of fresh vegetables, starch content decreased due to the sweeteners under the effect of enzyme. Total sugar when it is rises to a maximum and then decrease. In the first stage, reducing sugar content of all samples has decreased, however on the 15$^{th}$ of storage, there was an increase in the reducing sugar levels of all samples.

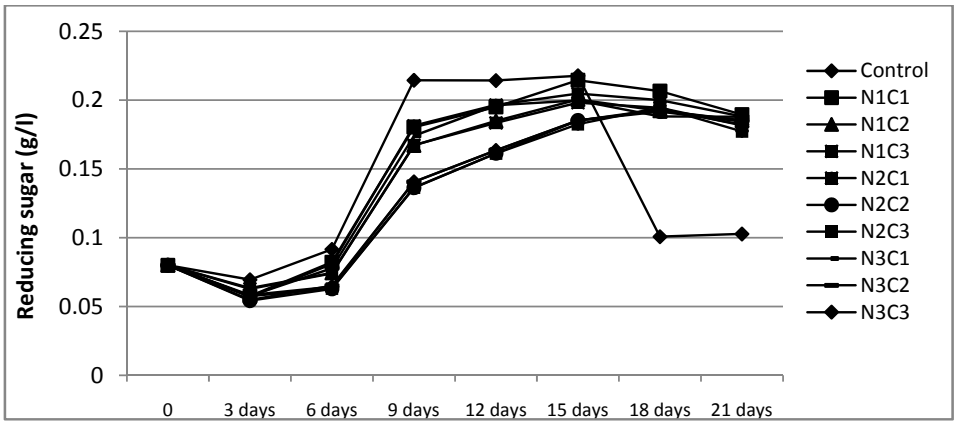


***Figure 2. Reducing sugar content of cucumber on the storage***

Pilar et al (2008) when preserving strawberries with chitosan combined with calcium salts gave the best results with chitosan at concentration of 1.5% compared with 1.0% chitosan, and not dependent the concentration of calcium. N2C2 form for better results than the sample N2C3, N3C2 and N3C3.

**Titrable acidity**

Many studies had shown that when the fruit ripens, the organic acid content tends to decrease. As the respiratory substrate, organic acid content (dominant) are used more than other substances and can be reduced up to 50% during the lifetime of the fruit. Malic acid is the substrate for respiration, organic acid content decreased during ripening of fruit.

In the process of preserving cucumbers with chitosan combined with extracts of Neem seed kernels, total acid content had decreased as the storage time increased (Figure 3). In the first stage, a few samples tended to increase but then decrease. Nadeem et al (2009) when preserving mango with chitosan, the results show acid content of all the samples were decreased with storage time. Huyen et al (2011) preserved longan with chitosan gave results that total acid content decreased with storage time, but not differences between samples. Thuy et al (2008) preserved lemons with chitosan, total acid content decreased over time and with chitosan concentration 1.5% showed that the decrease in acid content was lower than the control as well as samples with 1.0% and 2.0%. The inclusion of chitosan preservation was affecting the quality of fruit, levels of acid in the fruit had decreased slowly, chitosan have restrictions on the respiration of the fruit.

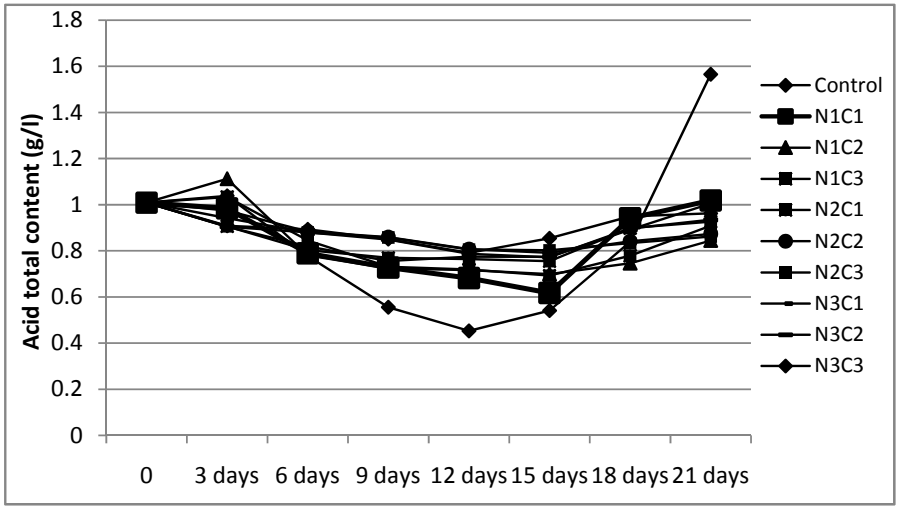


***Figure 3. Acid total content of cucumber on the storage***

The samples treated with chitosan shown the most obvious difference compared with control. Samples treated with chitosan at high concentrations generally decreased levels of acid slowly. N2C2, N2C3, N3C2 and N3C3 were different from the remaining samples. N2C2 and N2C3 samples showed the best result.

**CONCLUSION**

The combination of extracts of with chitosan was affecting the quality of cucumbers during storage. With higher concentrations of chitosan in combination with the neem seed kernels extract 120g/l gave good results.

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