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SYNTHESIS OF COMPLEXES OF N-SUCCINYLCHITOSAN COBALT AND THEIR INSECTICIDAL PROPERTIES AGAINST THE INSECT *HELICOVERPA ARMIGERA HBN*

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Chitosan (CS) is the only positively charged polysaccharide in nature and is obtained by the deacetylation of chitin. It is a biodegradable, microbial, and insect that is widely used in various fields for its anti-inflammatory activity.

Currently, in agriculture, synthetic pesticides are used to protect cotton plants from cotton bollworms (*Helicoverpa armigera Hbn*), such as *Avaunt* 15%, *Arrivo* 25%, *Benzophosphate* 30%, *Zolon* 35%, *Bulldog* 12.5%, *Vantex* 6%, *Danitol* 10%, and *Vertimek* 1.8%. Synthetic pesticide damage is beneficial to plants and animals and can contaminate soil and water. In addition, this has led to an increase in the number of pest insects resistant to pesticides. Therefore, the demand for biodegradable, environmentally safe, biologically active drugs is increasing annually. Preparations based on CS are also biodegradable, environmentally safe preparations.

Cd nanoparticles coated with CS polymer and extracted from *Plumeria alba* flowers were synthesized by mixing. The insecticidal activity of cadmium nanoparticles coated with chitosan against *Helicoverpa armigera* and *Spodoptera litura pests* and *Anopheles stephensi*, *Aedes aegypti*, *and Culex quinquefasciatus* mosquitoes has been studied [1]. Additionally, the insecticidal activity of CS and chitosan-metal complexes as absorbent pests against the cotton plant pests *Spodoptera littoralis* and *Aphis nerii* is related to the molecular mass and degree of deacetylation of chitosan. In particular, preparations based on chitosan with a molecular mass in the range of 227--597 kDa have been shown to have the highest efficiency in the fight against harmful insects [2-4].

The degree of deacetylation (DD) of CS is soluble in water, with an average of 86%, and various molecular masses of N-succinylchitosan (N-SCS) and its complexes containing Co^{2+} ions have been synthesized [5]. N-SCS interacts with Co^{2+} ions, forming a chemical bond through carboxyl (-COOH) groups. The insecticidal activity of N-succinylchitosan cobalt (N-SCS/Co^{2+}) solutions of different molecular masses and concentrations against *Helicoverpa armigera Hbn*, which causes great damage to cotton plants, was studied, and the efficiency was found to be 62.5%-87.5% (Figure 1).

As shown in the figure, when N-SCS/Co^{2+} (CS MM= 198 kDa) was treated with the solution, 25% mortality was recorded on the 3rd day of the experiment, 75% mortality was recorded on the 7th day of observation, and 87.5% mortality was recorded on the 14th day. When N-SCS/Co^{2+} (CS MM=110 kDa) was used, the mortality rate was 25% on the 3rd day of the experiment, 50% on the 7th day, and 75% on the 14th day. In the N-SCS/Co^{2+} (CS MM=18 kDa) sample, the biological efficiency was relatively low, and the mortality rate was 25% on the 3rd day of the experiment, 50% on the 7th day, and 75% on the 14th day.

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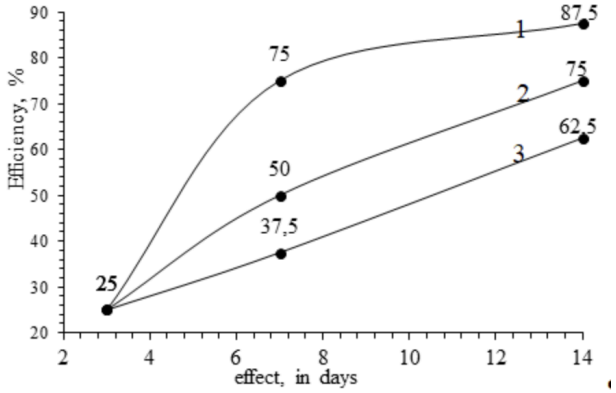


Figure 1. Effect of chitosan solutions with different molecular masses and DD=86% on the suppression of the harmful insects *Helicoverpa armigera* Hbn:1) N-SCS/Co^{2+} (CS MM=298 kDa), 2) N-SCS/Co^{2+} (CS MM=110 kDa), and 3) N-SCS/Co^{2+} (CS MM=18 kDa)

As seen from the above experiment, the biological efficiency also increased with increasing molecular mass of CS in the samples. This is probably due to the large number of amino groups in the macromolecule chain.

Thus, water-soluble N-SCS/Co^{2+} samples were synthesized on the basis of N-SCS and cobalt(II) chloride salt. When the insecticidal properties of N-SCS/Co^{2+} solutions, N-SCS/Co^{2+} (CS MM=198 kDa), which have relatively high biological efficiency, were studied, the mortality rates of *Helicoverpa armigera Hbn* pests on the 3rd day of the experiment were 25%, and those on days 7--14 of observation were 75% and 87.5%, respectively. The N-CX3/Co^{2+} samples synthesized on the basis of high-molecular-weight CS had high insecticidal efficiency, and the efficiency in the 1% solutions was greater than that in the control.

The N-SCS/Co^{2+} solution is of future interest in agriculture as an effective agent against the insect pest *Helicoverpa armigera Hbn*, which causes significant damage to cotton crops.

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