

CHITOSAN DERIVATIVES - SYNTHESIS AND CHARACTERIZATION

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Introduction

Recently, interest in chitin, chitosan and its derivatives, in particular carboxymethyl chitosan, has increased. It is associated not only with the growing interest in environmental protection or ecology but with their properties. Chitin belongs to the group of biodegradable polymers. It is a polymer that occurs in nature as ordered crystalline microfibrils forming structural components in the exoskeleton of arthro-pods or in the cell walls of fungi and yeast. It is also produced by several other living organisms in the lower plant and animal kingdoms. The most important derivative of chitin is chitosan. When the degree of deacetylation of chitin reach about 50% (depending on the origin of the polymer), it becomes soluble in aqueous acidic media and is called chitosan. Chitosan is biocompatible, biodegradable, non-toxic and low immunogenicity. Unfortunately, it has low solubility in water. This problem is solved by its water-soluble derivatives such as carboxymethyl chitosan. This is polymer in which the carboxymethyl group is introduced at various places either into the amino group or into the hydroxyl group on the C6 atom. It is used in medicine as a wound dressing, drug delivery or used in tissue engineering. Carboxymethyl chitosan is a polymer that has better biological and physicochemical properties compared to chitosan. [1-4]

Materials and Methods

Chitosan, low molecular weight was supplied by Aldrich Chemical Company, Inc. Sodium hydroxide, sodium chloride was purchased from POCH S.A. (Avantor, Poland). Chloroacetic acid Hydrochloric acid, Isopropyl alcohol was supplied Chempur (Poland). The methods of synthesis were taken from the literature (C. Yu et al. and A. Labidi, et al.).

2.7 g of sodium hydroxide was dissolved in 4 mL of H₂O and 16 mL of isopropanol and mixed with 2 g of chitosan. The solution was left at room temperature for 1 h. Next, 3 g of monochloroacetic acid in 4 mL of isopropanol were dropwise added to the mixture for 30 min. Later mixture was in under reflux at 55°C for 4 h. After cooling, impurities were removed by filtration. The product was precipitated by the addition of 80% ethanol. The product was then dried under vacuum or lyophilized.

2 g chitosan was added into 7.6 g 40% NaOH aqueous solution. Then, 20 mL isopropyl alcohol with 3.4 g chloroacetic acid were added into the flask Afterwards mixture was in under reflux at 65 °C for 4 h. After cooling, impurities were removed by filtration. The product was precipitated by the addition of 80% ethanol. The product was then dried under vacuum or lyophilized. The obtained chitosan derivatives were characterized using capillary viscometer and spectroscopy study.

Results and Discussion

In ethanol, chitosan derivatives formed white fibrous structures. After drying, the synthesis products had a slightly yellow colour. Depending on the synthesis, the intensity of the colour varied. Based on the spectroscopic analyses, one can notice differences between the obtained chitosan derivatives. The viscosity of carboxymethyl chitosan solutions and the average molecular weight were determined based on viscometric measurements. The results obtained for individual derivatives are different.

Conclusions

Analysis of the results shows that the change of synthesis parameters affects to the properties of the chitosan derivatives.

Acknowledgements

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References

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