INFLUENCE OF CHITOSAN ORIGIN ON THE PROPERTIES OF ITS DERIVATIVES

MARTA SZULC*, KATARZYNA LEWANDOWSKA

DEPARTMENT OF BIOMATERIALS AND COSMETIC CHEMISTRY,
FACULTY OF CHEMISTRY,
NICOLAUS COPERNICUS UNIVERSITY IN TORUN, POLAND
*E-MAIL: MARTA.SZ@DOKTORANT.UMK.PL

[ENGINEERING OF BIOMATERIALS 163 (2021) 25]

Introduction

Chitosan is a natural polymer that can be obtained from crab, squid or shrimp shells, and we can also obtain it from mushrooms such as *Aspergillus niger*. Chitosan is insoluble in water, but it is biodegradable and non-toxic. One of the derivatives is carboxymethyl chitosan. Carboxymethyl chitosan (CMCS) is formed by the substitution of a carboxymethyl group for an amino group and/or a hydroxyl group. It has better physicochemical and biological properties than chitosan and is also water-soluble. [1-3] The purpose of this study was to investigate the influence of various chitosan origin on the properties of chitosan derivatives.

Materials and Methods

Chitosan from squid, chitosan from *Aspergillus niger* was purchased from POL_AURA. Sodium hydroxide, sodium chloride was received from POCH S.A. (Avantor, Poland). Chloroacetic acid Hydrochloric acid, Isopropyl alcohol was supplied Chempur (Poland). The method of synthesis was taken from the literature [1]

The obtained chitosan and chitosan derivatives were characterized using viscometric technique and infrared spectroscopy. The intrinsic viscosity of carboxymethyl chitosan in 0.1 mol/L NaCl aqueous solution at 30°C was carried out in an Ubbelohde capillary viscometer. For the chitosan samples the intrinsic viscosity was measured in 0.1 mol/L CH_3COOH/0.2 mol/L NaCl aqueous solution at 25°C. The viscosity average molecular weight was calculated according to the Mark–Houwink equation [4]. FTIR spectra of the used chitosan samples and chitosan derivatives were recorded on VERTEX 70v FT-IR Spectrometer (Brucker Optics Inc), in the wavelength range between 4000 – 400 cm^{-1}, resolution of 2 cm^{-1} and 60 – times scanning. The degree of substitution of each chitosan derivatives was obtained by potentiometric titration [5].

Results and Discussion

The synthesis products had a slightly yellow colour. Depending on the origin, the intensity of the colour varied. Obtaining N, O-carboxymethyl chitosan from both syntheses was confirmed based on spectroscopic analysis. This was confirmed by the appearance of characteristic peaks at wave numbers of 1590 cm^{-1}, 1410 cm^{-1}.1320 cm^{-1} (FIG. 1). The intrinsic viscosity of carboxymethyl chitosan solutions and the viscosity average molecular weight were determined based on viscometric measurements. It was also found that a large decrease in the molecular weight and GLL of catboxymethyl chitosans relative to chitosan (TABLE 1).

The resulting derivatives have varying degrees of substitution and average molecular weight.

Conclusions

The analysis show that the origin of chitosan influences the properties such as degree of substitution and viscosity average molecular weight of its N,O-carboxymethyl chitosans.

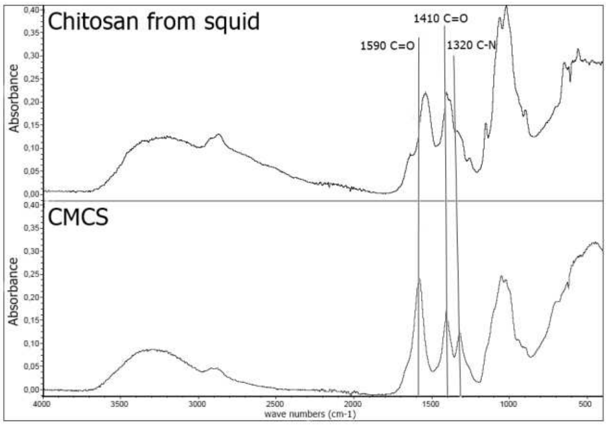

FIG. 1. FT-IR spectra of CMCS and chitosan from squid.

TABLE 1. Comparison of the viscosity average molecular weights and GLL of the CMCS and chitosan from squid.

Sample	GLL [cm^3/g]	Mv [g/mol]
Chitosan from squid	647	$9.36*10^5$
CMCS	237	$2.993*10^5$

References

[1] Chen Yu, Liu Yun-fei, et al., Carbohydr. Polym. 75, (2009) 287-292.
[2] Z. Shariatinia., Int. J. Biol. Macromol. 120 (2018) 1406–1419.
[3] K. Lewandowska, Int. J. Biol. Macromol. 147 (2020) 1156–1163.
[4] M. R. Kasaai, Carbohydr. Polym. 68 (2007) 477–488.
[5] M. Lei, W. Huang et al., Appl. Clay Sci. 193 (2020) 10563.