

Paper ID: A192

Producing Different Grades of Chitosan Oligomers

N. D. Aljbour,^{1,2*} M. D. Beg,^{1,2} J. Gimbut^{1,2}

¹ Faculty of Chemical & Natural Resources Engineering, ² Centre of Excellence for Advanced Research in Fluid Flow (CARIFF), , Universiti Malaysia Pahang, 26300 Gambang, Pahang, Malaysia.

****Nawzat Aljbour: nawzat_jbour@yahoo.com***

EXTENDED ABSTRACT

Chitosan, the second most abundant natural polymer used in the world after cellulose, it has attracted attention long time since it is a polycationic polymer and could be utilized in different applications especially in food, medical, and pharmaceutical fields. The major disadvantage of chitosan is its insolubility in water, while it is soluble in dilute acidic solutions such as hydrochloric acid and acetic acid. Low Molecular Weight Chitosan (LMWC) has superior properties compared to the High Molecular Weight Chitosan (HMWC), especially its water solubility in addition to the antibacterial and antifungal properties which will open new horizons for LMWC to different applications especially in the cosmetics, food, and pharmaceutical industries. LMWC could be produced from the native HMWC using different hydrolysis method such as acid hydrolysis, enzymatic hydrolysis, and oxidative hydrolysis using nitrous acid and hydrogen peroxide. In addition to the mechanical methods such as ultra-sonication and radiation. For the industrial scale depolymerization, the acid hydrolysis using diluted hydrochloric acid is preferred because it is considered simple and practical method and resulted in a very good yield up to approximately 85%, also the concentration of hydrochloric acid (2M) is considered less corrosive and aggressive effects compared with other methods. The produced LMWT grades were characterized by FTIR, NMR, and X-Ray Powder Diffraction. Also the molecular weight of each prepared grade was determined using the intrinsic method in addition to the laser diffraction method, and the % degree of deacetylation was determined by the acid hydrolysis method. The obtained results of molecular weight determination showed that the prepared grades using 2M Hydrochloric acid depolymerization are considered of narrow range of polydispersity, then by this method the major problem of the commercial chitosan, the polydispersity could be solved. On the other hand the obtained LMWC grades were fully deacetylated. In order to get grades with specific %DDA's an acetylation reaction could be carried out using different amounts of acetic anhydride. In this work LMWC in three molecular weight ranges were prepared ($M_{wt} < 5000$, $10000 < M_{wt} < 20000$, and $20000 < M_{wt} < 50000$) and for each range we prepared three different degrees of deacetylation (100%DDA, 80%DDA, & 60%DDA).

Keywords: Chitosan Oligomers; Degree of deacetylation; Acid hydrolysis; polydispersity.

References

- [1] Wu, T., Zivanovic, S., Hayes, D.G., Weiss, J. (2008) Efficient reduction of chitosan molecular weight by high-intensity ultrasound: Underlying mechanism and effect of process parameters. *J. Agric. Food Chem.* 56: 5112–5119
- [2] Einbu, A., Grasdalen, H., Varum, K.M. (2007) Kinetics of hydrolysis of chitin/chitosan oligomers in concentrated hydrochloric acid. *Carbohydr. Res.* 342: 1055–1062.
- [3] Vårum, K.M., Ottøy, M.H., Smidsrød, O. (2001) Acid hydrolysis of chitosans. *Carbohydr. Polym.* 46: 89–98.

[4] Krishnan, R.A, Deshmukh, P., Agarwal, S., Purohit, P., Dhoble, D., Waske, P., Khandekar, D., Jain, R., Dandekar P (2016) Proton play in the formation of low molecular weight chitosan (LWCS) by hydrolyzing chitosan with a carbon based solid acid. Carbohydrate Polymers. 151: 417-425