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Emulsifying Property of Carboxymethylchitin

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Introduction

Chitin is the second most abundant natural polymer after cellulose. It is mainly extracted from crustaceous shells and cell walls of fungi, insects and yeast. Chitin is known to be insoluble in most common solvents except for strong acids or *N,N*-dimethylacetamid because of its rigid crystalline structure through intra- and intermolecular hydrogen bonds. Therefore, different derivatives have been prepared based on chemical and enzymic modification of chitin. The first derivative is chitosan, the fully or partially deacetylated chitin becoming soluble in aqueous acid conditions.

Chitin and chitosan are copolymers composed of *N*-acetyl-*D*-glucosamine units. Chitin and chitosan have been developed as new physiological materials since they possess antibacterial activity, hypocholesterolemic activity and antihypertensive action. Even though chitin and chitosan have very strong functional properties in many areas, their high molecular and high viscosity may restrict the uses in various industry. So, various studies were conducted to make water-soluble derivatives of chitin and chitosan by chemical modification techniques.

The previous studies were reported that carboxymethylchitin (CM-chitin) have functional properties such as induce macrophage activation, adsorption of blood components (1), drug carrier (2) and surface activity. In particular, the surfactant-polyelectrolyte compounds on the basis of natural polyelectrolytes as derivatives of chitin are of special importance for practical applications in medicine, pharmaceutics and cosmetics.

In this study, we compared to the emulsifying activity of CM-chitin and the other emulsifier, and the optimum conditions enhancing emulsifying activity of CM-chitin were measured.

Material and Methods

Materials, Chitin was donated from Kitto Life (Korea). Gelatin and soybean oil was purchased from Kyong-gi Gelatin Co and Haepyo Co. (Korea), respectively. Tween-80 was purchased from Junsei Chemical Co.(Japan). Monochloroacetic acid, iso-propanol, sodium dodecylsulfate and bovine serum albumine were purchased from Sigma(USA). All other materials were used reagent grade purity.

Synthesis of CM-chitin, In a modification of the method developed by Tokura et al. (3), chitin (1g) was suspended in 15M NaOH (12.5ml) and stirred for 60min at 20℃. The alkali-chitin was recovered by filtration on a sintered glass filter funnel under suction. The material was resuspended in a solution of monochloroacetic acid (1.5g) in iso-propanol

(12.5ml) and stirred 5 hr at 20℃. Then, 50ml of distilled water was added and the pH was adjusted to 7.0 with 11M HCl. After 24 hr the reaction mixture was filtered and the filtrate was precipitated with 5 volumes of acetone.

Measurement of emulsifying activity, The emusifying activity of sample solution was determined according to the method of Pearce and Kinsella. To prepared emulsions, 3.0ml of soybean oil and 3.0ml of 1%(w/v) CM-chitin solution were shaken together and homogenized in an Homogenizer at 12,000 rpm for 1 min at room temperature. A 50 L sample of emulsion was taken from the bottom of the container, and was immediately diluted with 5 ml of 0.1% SDS solution. The absorbance of the solution diluted with emulsion was then determined at 500nm by Spectrophotometer. The relative emulsifying activity was determined from the absorbance immediately measured after the emulsion formation. On the other hand, the emulsion was centrifuged (800g, 10 min) at room temperature, the emulsion were transferred into a test tube, and then was measured to emulsion layer volume (Ve) and total volume (Vt). The emulsifying activity was represented by the emulsifying index = (Ve/Vt)100.

Conclusions

To improve the functional properties of chitin, enzymic and chemical modifications have been extensively employed. CM-chitin is a water-soluble derivative of chitin, be Carboxymethylated in 3- and 6-positions to varying extents. CM-chitin is soluble not only in acidic media but at any pH, making it an attractive option in connection with its use in food products and cosmetics. Emulsifying activity of CM-chitin was higher 20% than that of gelatin, bovine serum albumine, and Tween-80 as commercial emulsifier. For enhance to emulsfying activity of CM-chitin, optimum conditions such as concentration, water/oil ratios, pH and temperature of CM-chitin solution were measured. Emulsifying activity of 1% CM-chitin solution was higher than that of the other concentrations. Optimum conditions of water-oil ratios, pH and temperature were 1:1(v/v), pH 8.0 and 2 0℃, respectively. In these results, emulsifying activity of CM-chitin solution was 86%, which enhanced about 12% than that of the other conditions.

References

1. S. Nishimura, Y. Ikeuchi and S. Tokura, The adsorption of bovine blood proteins onto the surface of 6-o-(carboxymethyl)-chitin. Carbohydr. Res. 134, 305-312 (1984).

2. K. Watanabe, I. Saiki, Y. Uraki, S. Tokura and I. Azuma, 6-O-Carboxymethyl-chitin (CM-chitin) as a drug carrier. Chem. Pharm. Bull. 38, 506-509 (1990).

3. S. Tokura, N. Nishi, A. Tsutsumi and O. Somorin, Studies on chitin VIII. Some properties of water soluble chitin derivatives. Polym. J. 15, 485-489 (1983).