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# Application of Gamma Radiation and Physicochemical Treatment to Improve the Bioactive Properties of Chitosan Extracted from Shrimp Shell

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**Abstract**

The aim of this study is to improve the different bioactive properties of chitosan extracted from chitin by different physicochemical treatments including gamma radiation. Chitin was prepared from shrimp shell upon deproteination, decalcification and oxidation with 4% NaOH, 4% HCl, and 2% H2O2 respectively. To find out a more efficient, economically reasonable and time saving chitosan extraction method other than existing methods, eight different physicochemical treatment methods (designated as A, B, C, D, E, F, G and H) varying different parameters were applied for chitosan extraction. Chitosan produced by these extraction methods were compared with commercially available chitosan and assessed with respect to degree of deacetylation (DD-value), molecular weight, antimicrobial activity and solubility. DD-value of chitosan extracted by method A, B, C, D, E, F, G and H were 75.0±0.28%, 92.0±0.34%, 81.0±0.51%, 89.0±1.34%, 69.0±0.05%, 87.0±0.35%, 82.0±1.4% and 92.0±0.92% respectively whereas the DD-value of the commercially available product was ˜75.0%. Viscosity-average-molecular-weights were found 1.77×105±0.28, 1.6×105±0.50, 1.82×105±0.46, 1.19×105±0.39, 2.25×105±0.39, 1.41×105±0.67, 1.77×105±0.28 and 1.16×105±0.69 Dalton respectively. Antimicrobial activity of all chitosan samples was found insignificant and all the samples could be dissolved completely at minimum 0.5% of acetic acid solution.

For further quality improvement, chitosan with highest DD value (prepared by method B) was irradiated with different doses (5.0, 10.0, 15.0 and 20.0 kGy) of gamma radiation and again assessed for different quality parameters. Though no significant changes in DD value of chitosan was observed upon irradiation, it causes significant changes in the molecular weight of chitosan samples. Molecular weight gradually decreased as the radiation dose increased. Molecular weight of the samples treated with the radiation doses of 5.0, 10.0, 15.0 and 20.0 kGy were 1.786×103, 1.518×103, 1.134×103 and 1.046×103 Dalton respectively. Radiation treatment of chitosan samples also increased the antimicrobial activity in concentration dependent manner. One and half (1.5%) percent chitosan solution treated with a radiation dose of ˜10.0 kGy showed highest antimicrobial activity.

Repeated alkali treatment (20 M NaOH) and autoclave for 30 minutes was found to be the best extraction method and irradiation of chitosan solution with 5.0 to 10.0 kGy further increased its bioactive characteristics including enhanced antimicrobial and solubility properties.

## Country/Organization invited to participate

Bangladesh

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