Contribution ID: **167** Type: **Poster**

Determination of the Radiation Dose Required to Obtain Desired Viscosity Average Molecular Mass Using Commercially Avaible Chitosan and Signification of this Technique in its Applications

Thursday, 27 April 2017 14:15 (2 hours)

Radiation processed chitosan polymers are used in many applications in the field of Agriculture such as plant growth promoters, elicitors, fungicides and self-life extending coatings for fruits etc. Radiation or chemical degradation techniques or a combination of both methods can be used to convert higher molecular masses of chitosan to its different low molecular masses. The applicability of the chitosan in the above applications highly depends on the molecular weight of chitosan. However viscosity average molecular masses of commercially available chitosan (CAC) show huge variations and these variations arise due to the use of different techniques in the extraction process. This variation of the molecular masses of the CAC makes it difficult to determine the correct radiation dose to obtain the desired molecular weight. The main objective of this study is to construct a correlation between the variation of viscosity average molecular mass of CAC samples vs. irradiated doses. The above correlation enables the determination of the radiation dose required to get the desired molecular weight from a known initial molecular weight. The viscosity average molecular mass is the key factor of the performance of the products developed using chitosan.

CAC samples with similar degree of deacetylation (DDA) and various molecular masses were irradiated at different radiation doses using GC-5000 Gamma Cell under 3.4 kGy/h dose rate. The viscosity average molecular mass of these irradiated samples were analyzed using Capillary Viscometric method. AVS 470 Visco system with a standard solvent system (0.25 M CH3COOH/ 0.25 M CH3COONa at 25oC) and Mark-Houwink-Sakurada equation were used for the determination of viscosity average molar masses. The relationship between the varying viscosity average molar masses vs. absorbed dose was constructed using regression analysis and desired molecular weight was obtained using this relationship.

Oligo chitosan with selected molecular masses are used in the production of some agro-products and the above technique can be used as an initial step of the production of oligo chitosan with required molecular weight using CAC. Oligo chitosan can be produced using a combination of chemical and Gamma irradiation techniques (synergic technique) in aqueous media. However, a standard procedure cannot be followed in the production of oligo chitosan due to the dissimilarities of the molecular masses of CAC. Therefore, a fixed initial molecular weight (compatible with existing standard procedure) should be produced using CAC in order to follow a standard procedure based on the synergic technique. The regression curve developed under this study was used to find out the required dose to produce fixed molecular weight using CAC. Therefore the procedure developed through the above study can be utilized to derive the fixed low molecular weight chitosan to follow the standard procedures used in pilot and commercial scale productions of Agro products which are based on Oligomer/Low molecular weight chitosan.

Country/Organization invited to participate

Sri Lanka

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Session Classification: P-A2

Track Classification: RADIATION SYNTHESIS AND MODIFICATION OF MATERIALS