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Effect of γ-Irradiation on the Molecular Weight and Structure of Guar Gum

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Background

This work was done in order to evaluate the degradation in polysaccharides structure of food additives guar gum processed with γ-irradiation. The IR absorbance spectra of the material prior to irradiation is a good tool to determine the molecular weight and molecular weight distribution.

Material and method:

Guar gum samples were irradiated in powder and aqueous solution in two
concentration (1 and 0.5 g/100 mℓ prepared at room temperature) with different doses (0, 2.5, 5, 7.5, 10, 20, 30, 40 and 50 kGy) of ^{60}Co γ-rays (0 held as control sample). The changes of molecular weight and structures of the processed samples were investigated and characterized using Fourier-transform infrared spectra (FTIR), ultraviolet-visible spectral (UV-vis). The results showed the molecular weight decreased gradually with increasing irradiation dose.

The infrared spectra of the control and irradiated powder were recorded using Ashemaduze model Fourier transform infrared spectrometer, in the range 4000–350 cm^{-1}. The KBr pellet technique was adopted for recording the spectra. The solid samples were obtained through following the procedure of adsorption measurement. Approximately 2 mg of desired powder sample was
thoroughly mixed with 200 mg of spectroscopic grade KBr and pressed
into pellets for recording the spectra. The measurement was carried out by transmittance scans of dilute solutions of 0.5 and 1% from control, irradiated powder samples and standard (solutions of 1% Glactose, 1% Mannose) and irradiated solutions concentration (0.5 and 1%) in the wave length range 250–600 nm.

Results and dissection:

Results by FTIR and UV-Vis spectra showed that the effect of irradiation on guar gum is random. Especially with high doses FTIR spectra indicated that γ-irradiation introduced no significant changes into the structure and crystal texture, but UV spectra showed an absorption peak at about 265 nm, increasing with irradiation dose, which was attributed to the formation of carbonyl groups or double bond.

Conclusion:

γ-irradiation effects on guar gum properties (chemical and physical) depend on the state of the gum when irradiated as powder or solution. The effect of the same dose in low concentrations is more than in high concentrations.

Country/Organization invited to participate

Sudan/Atomic Energy Commission

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