Effect of gamma Irradiation on the Molecular Weight and Structure of Guar Gum

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Introduction

This work was done in order to Evaluate the degradation in polysaccharides structure of food additives Guar gum processed with gamma irradiation Considering the change in the Chemical nature of irradiated material will allow to usually examining the molecular weight .The IR absorbance spectra of the material prior to irradiation can be good for the molecular weight and molecular weight distribution determined.

Material and method:

Guar gum samples were irradiated in powder and aqueous solution in two concentration (1 and 0.5 gram per 100 ml prepared at room temperature) with different doses (2.5, 5 7.5, 10,20,30,40 and 50 kGy) of γ-rays from Co60- and take 0 as control sample. The changes of molecular weight and structures of processed samples were investigated and characterized by using Fourier-transform infrared spectra (FTIR), ultraviolet–visible spectral and (UV–vis), analysis Results showed the molecular weight decreased gradually with increasing irradiation dose. FTIR spectra indicated that γ-irradiation introduced no significant Changes into the structure and crystal texture, but UV spectra showed a distinguished absorption peak at about 265 nm, increasing with irradiation dose, which was attributed to the formation of carbonyl groups or double bond.

Results and dissection:

The infra red spectra of the control and irradiated powder were recorded using ashemaduze model Fourier transform :infrared spectrometer, in the range 4000-350Cm-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 200mg of spectroscopic grade KBr and pressed into pellets for recording the spectra. Using UVprobe233) shemaduze .The measurement was carried out by taking scan for transmittance of dilute solutions of sample of control (0.5 and 1%), standard (solutions of1% Glactose, 1% Mannose) and irradiated solutions concentration (0.5 and 1%) in the range of wave length 400-600nm.

FTIR Analysis Result:

Comparing the absorbance of the irradiated sample with that of control (zero kGy) it found that peaks in control sample as shown in(fig 34) are at (811, 869, 1004, 1078, 1151, 1417, 1647, 2921 and 3446 cm−1), the same peaks appear in the sample irradiated with (2.5 kGy) with increase in intensity. But the peak (1417) cm−1 disappeared.In case of irradiated sample with (5 kGy) the same peaks as in control with increasing of intensity and the disappeared peak appear at (1456 kGy) (fig01). The sample of dose (7.5 kGy) the number of peaks decreases with decrease in intensity of peaks as shown in fig (1). We can refer that to break of some bonds (jana,2001). Also the sample irradiated with(10 kGy) show eight peaks in the same range as in control but absence (1417) cm−1 (fig 01) , In (20kGy) ten peaks appear and all of them are in medium intensity and the new peaks are (1070,1222) cm−1 and as in all previous samples the peak at 2925cm−1has high value of intensity .When irradiated with (30 kGy) there are 10 peaks at the same region of (another guar gum samples but the new one is (2136 cm−1)which has the high value in intensity and not as usual (2936cm−1) was in the third order in intensity in this cause, for the dose (40kGy) when guar gum powder irradiated with this dose it's FT-IR spectra appear as the main peaks which present in control but with very low intensity and new peak was at (1220,1074 and 1012 cm−1) the effect of (50 kGy) on guar gum powder, .the peaks are in the same region with small difference but large in intensity .

According to (Jing,2007) for guar gum the band at(3430cm−1) represents (O-H) stretching vibration .The band at (2942) cm−1 is due to(C-H) stretching of the (CH2) groups. The band due to ring stretching of Glactose and Mannose appears at (1641 and 1657cm−1). In addition the bands in the region (1350,1450 cm−1) are due to symmetrical deformation of CH2 on (C-OH) groups. The bands due to primary alcoholic CH2OH stretching mode and CH2 twisting vibration appear at (1078 and 1021 cm−1), respectively. the bands around 890cm-1 can be attributed to the(X-H) deformation , the weak bands around 770cm-1 are due to ring – ring stretching and ring deformation of α -D (1-4)and α –D(1-6) linkage .

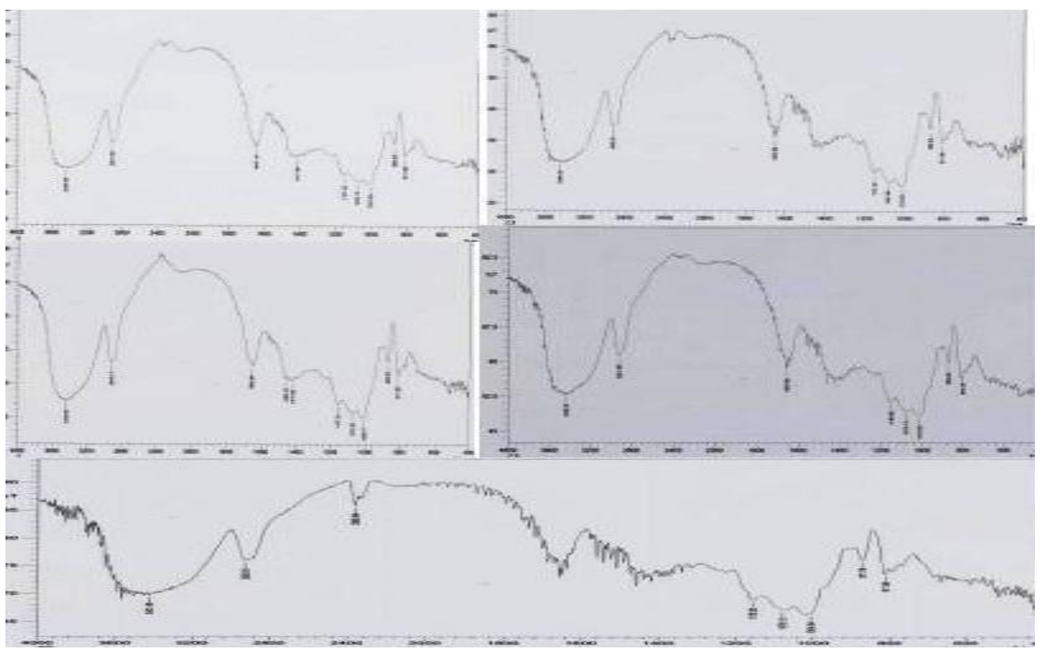

Fig-01FT IR spectrum of guar gum powder samples

Conclusion:

Results by FTIR and UV-Vis spectra showed that Effect of irradiation on guar gum powder is random, especially with high doses. Accordingly, it can be concluded that:

- Gamma 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 solution of low concentrations is more than it in high concentrations)
- the effect of doses depends on the physical state of the sample and its concentration.)
- Effect of irradiation on the molecular weight and rheological properties of the samples became more pronounced when using high doses.

References:

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