

Modifications of Viscosity Properties and Molecular Weight of Polysaccharides by Gamma Irradiation

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Abstract

the effect of gamma irradiation on the Polysaccharides of guar gum. Was determined in viscoelastic properties of the aqueous suspensions of irradiated guar gum at different concentrations (0.1– 0.5%) was measured also the effect on solutions made of irradiated powder of guar gum was going under study. the samples were irradiated using a Co60 gamma-ray source with doses (2.5, 5 .7.5, 10, 20, 30, 40 and 50 kGy). The monitored rheological parameters showed the non-Newtonian behavior of treated samples. The decrease tendency of the viscosity by irradiation and with decrease of the concentration as well has been noticed. And that vary with the change occur in molecular weight

1- Introduction

1.1 Polysaccharides:

Natural and synthetic polymers containing hydroxyl groups have been used as thickeners for foods, coatings, paints, explosive slurries, oil well fluids, cosmetics and other personal care products, and many other functional applications. One class of polymers that have been widely used as suspending and viscosity agents are poly Galactomannans. (Guar Gum).

2 -Materials and methods

The main materials used in this study are commercial guar gum powder (food grade) obtained from (Sudanese Guar Gum Company), deionized water, distilled water, and some standard solution of Glactose and Manose.,

2.1 Radiation Techniques:

The Main technique used is Co-60 gamma irradiation unit, the powder and solution s of Gum were kept into sterilized polyethylene tightly vials and then irradiated at room temperature in air. The radiation doses calculated to be time of exposure.

2.2 Sample preparation and irradiation

The powder and solution s of Gum were kept into sterilized polyethylene tightly vials and then irradiated at room temperature in air. The radiation doses calculated to be time of exposure. After samples irradiation (1, 0.5). gram of each sample (in cause of powder state)was taken and dissolved in 100ml de ionized water (at room temperature)shacked well and wait till homogeneous ,then the pH and viscosity ware measured , for irradiated solution which prepared as mentioned above the pH and viscosity measured after irradiation with in 24 hours .

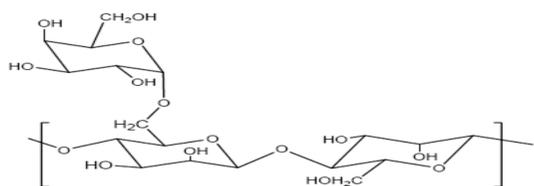


Fig 1. Chemical structure of Guar Gum (Galactomannan) he ratio between sugars

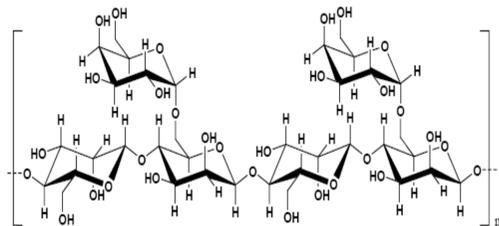


Fig 2. Chemical structure of Guar Gum(Galactomannan) Mannose backbone and Glactose

Viscosity average molecular weights (Mw) were calculated by equation 1, the Mark-Houwink equation given by Doublier and Launay and modified by Gaisford ,et al. (Edwin.G.2006). For Guar Gum. $[\eta] = 11.55 \times 10^{-6} [(1-r) M w]^{0.98}$ (1)

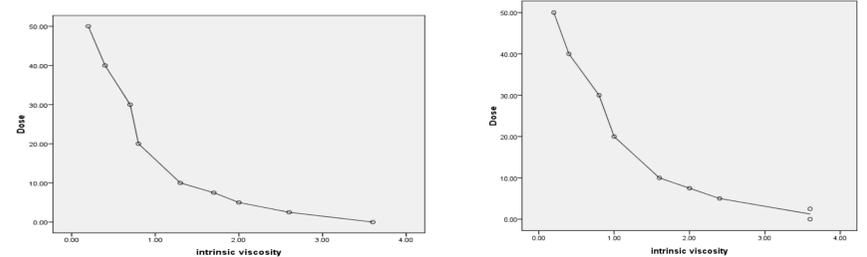
Results

When measuring viscosity of 1% and 0.5% of irradiated solutions. The viscosity of 1% is always higher than that of 0.5% fig (3.) and this agree with that found by (Iapasin, Pricle.1995). From this investigated the parameters, intrinsic viscosity measurements for determining the Molecular Weight of Guar, which would be very useful in modifying Chain architecture of Galactomannan to alter its properties which would open new opportunities for the use of Guar.

Molecular Weight determination result:

It is very well known that polysaccharides in dry form or in solution degrade when exposed to ionizing radiation for the investigation of the effect of gamma rays on the Molecular weight of Guar Gum (G G) so from the equation mentioned above eq (1) using intrinsic viscosity to determine the Molecular Weight. Find that (detailed in figs (3) to fig(8) the Molecular Weight of irradiated powder OR solution of Guar Gum affected .and we can see the big difference of Molecular Weight of control sample and irradiated samples it decrease rapidly with increasing doses of irradiation.

the maximum decrease was determined for the dose 50 KGy and that can be refer to high degradation of that dose in the Guar Gum molecule (Galctomanane degradation) In cause of irradiated Guar in powder form we can see that the decrease in Molecular Weight is depend on dose . the same result was found to be the effect of irradiation on solution of Gum in both concentration (0.5%and1%) and the decrease of Molecular Weight depend on the concentration of solution so its high for 0.5% from here we recognized that the effect off irradiation on Molecular of Gum depend mainly on concentration of solution and there is relation between decrease Molecular Weight and viscosity of that solution .For all sample the Molecular Weight is be in that range reported for Guar Gum under different h condition and different pH and gamma irradiation or some modification as salt addition or sugar , results of(Ganal.1996)and(Nadhini and Abhilash.2010) .



fign 3 .Intrinsic viscosity variation with doses of 1% solution of irradiated powder

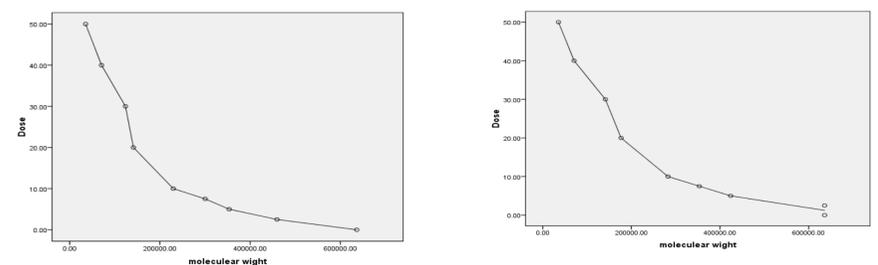


Fig 4. Molecular weight variation with doses of 1% solution of irradiated solution, powder

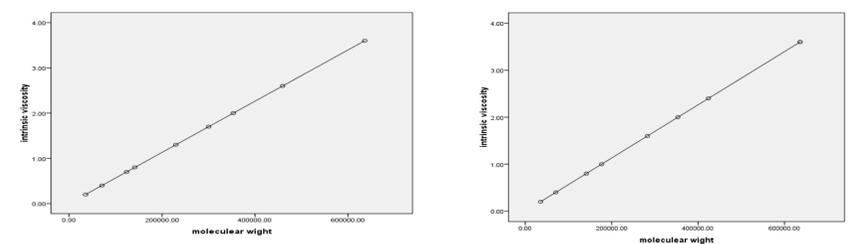


Fig 5. Intrinsic viscosity variation with molecular weight of 1% solution of irradiated powder

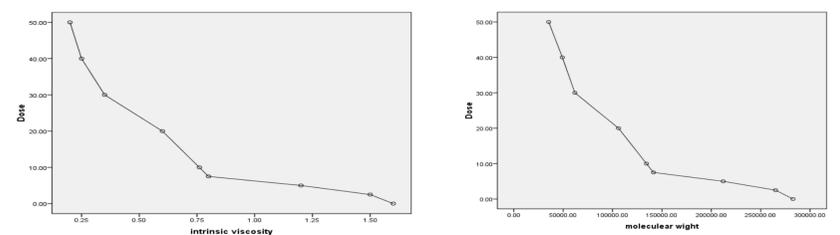


Fig 6. Intrinsic viscosity variation with doses of 0.5% irradiated solution
Fig 7. Molecular weight variation with doses, of 0.5% irradiated solution

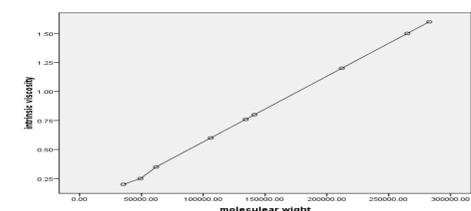


Fig 8 . Intrinsic viscosity variation with molecular weight, of 0.5% irradiated solution

Conclusion

The viscosity values for all studied concentrations decreased by irradiation. This aspect suggests a depolymerization phenomena of the aqueous Guar Gum solutions. This study contributes to the knowledge of the viscoelastic properties of Guar Gum as powder or aqueous solution, with application for food, agriculture and medical products. Petroleum and construction.

References

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