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ELECTRON BEAM IRRADIATION EFFECTS ON XANTHAN GUM. RHEOLOGICAL ASPECTS.

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Xanthan gum is a well-known microbial polysaccharide produced by *Xathomonas campestris* with a tradition of 3 decades in the hydrocolloid market [1][2]. Their chemical properties arise from its structural composition: contains D-glucose, D-mannose and D-glucuronic acid as the main hexose units in a 2.8:3.0:2.0 ratio; also contains pyrovate and is partially acetylated. Their molecular mass ranges from $13x10^6$ to $50x10^6$. The free-flowing powder of xanthan gum dissolves readily in water with stirring to give highly viscous solution at low concentration. It forms strong films on evaporation of aqueous solutions. It is applied by the food and cosmetics industries as stabilizer and emulsifying agent.

Food ingredients to be used for food processing should be decontaminated in order to prevent food spoilage and food-borne diseases. Irradiation with ionizing radiation is one of the most effective means to disinfect dry food ingredients. Also, radiation processing to shelf-stable, ready-to-eat meals is increasingly applied [3]. Only certain radiation sources can be used in food irradiation. These are radionuclides (cobalt-60 or cesium-137); X-ray machines having a maximum energy of 5 MeV or electron accelerators having a maximum energy of 10 MeV. Electron beam (EB) processing has two main characteristics: 1) since electrons cannot penetrate very far into food, compared with gamma radiation or X-rays, they can be used only for treatment of thin packages of food and 2) EB has the shortest process cycle of any currently recognized sterilization method. Gamma processing normally exposes the product to the radiation source for a time period of some hours while EB processing exposure time is less than one minute. This time difference provides for less oxidative effects on the products with improvements in product shelf life and product appearance.

This paper describes the application of electron beam irradiation to xanthan gum as used as ingredient by the food or cosmetics industry in order to establish their radiosensitivity. The edible powder of xanthan gum samples were irradiated in 1mm thick layers on Petri dishes covered by a transparent PVC films using an EB accelerator Dynamitron (Radiation Dynamics Inc.) model JOB 188, dose rate 11.17 kGy/s, 0.637 MeV, 1.78 mA, 5 kGy per passage, 3.36 m min^{-1} with doses of 5, 10, 20 and 50kGy. One % aqueous solutions from irradiated and non-irradiated xanthan gum were prepared and the radiation effects were measured following viscosity changes at 25°C using a Brookfield viscometer; model DVIII, spindle L, with Rheocalc software. Viscosity measurements were performed according to our previous experience [4] and the results are the mean of at least 3 experiments.

Figure 1 presents the viscosity of 1% xanthan gum solutions as a function of EB radiation dose. As can be seen, viscosity of xanthan gum solutions decreased with the increase of the EB irradiation doses. The viscosity values were reduced to 96%, 89%, 78% and 34% for the samples irradiated

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with 5, 10, 20 and 50 kGy when compared with the unirradiated one suggesting a degradation or depolymerization of the polysaccharide macromolecules. From these results we can conclude that the detriment in the xanthan gum viscosity produced by EB irradiation must be taken in account whenever irradiation of this additive is involved but similarly to the effects on other polysaccharides it can be acceptable in many cases.

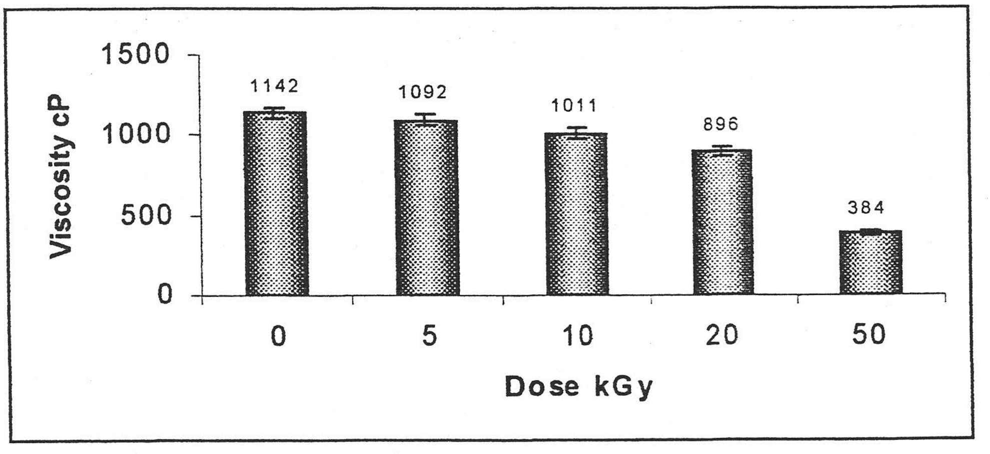

FIG. 1. Viscosity measurements of 1% xanthan gum solutions EB-irradiated with different doses.

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