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SOY ISOFLAVONE PROTECTION ON GAMMA IRRADIATED CARRAGEENAN SOLUTIONS

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ABSTRACT

In recent years, natural products and preparations for nutritional supplementation or dietary purposes are gaining increased attention. Animal studies have shown that dietary phytochemical antioxidants are capable of removing free radicals. Free radicals are very reactive chemical species, eventually evoking uncontrolled reactions resulting in oxidative damage of important biological macromolecules. Radical scavenging antioxidants are particularly important in the antioxidative defense to protect cells from the injurious effects of free radicals. Among them, phenolic and polyphenolic compounds such as flavonoids in edible plants, exhibit potent antioxidant activities. They are found in many fruits, vegetables and grains in variable contents with high amounts being found in soybeans, soy products and red clover, and are reported to have beneficial estrogenic effects in the treatment of menopausal disorders and cardiovascular diseases and may lower the risk of several cancers. Soy beans and soy products are known as the richest sources of the two estrogenic active isoflavones genistein and daidzein. Carrageenan, a colloidal extractive from algae is a galactose-containing polysaccharide used chiefly as a suspending agent in foods, pharmaceuticals, cosmetics and industrial liquids, as a clarifying agent for beverages and in controlling crystal growth in frozen confections. Ionizing radiation affects polysaccharides like carrageenan, widely used in food industry, through the modification of their rheological behavior. In this work soy isoflavone genistein was used in order to verify their capability as radiation protector in an in vitro system made of irradiated polysaccharides. One per cent aqueous carrageenan solutions were prepared. Soy isoflavone genistein was added in concentration of 0.5, 1.0, 1.5 and 2.0 g/ml-1. Co-60-irradiation was performed in a Gammacell 220 (AECL), dose rate about 4.38 kGy/h, with doses of 1.0 kGy, 2.5 kGy, 5.0 kGy, 7.5 kGy and 10.0 kGy. Radiation effects were followed by changes in the viscosity of irradiated solutions. The radioprotective action of the antioxidant soy isoflavone appears as dependent upon their concentration.

1. INTRODUCTION

Isoflavones are a group of naturally occurring heterocyclic phenols found mainly in soybean (*Glycine max*) and have been credited with performing several health-promoting functions [1].

In recent years, natural products and preparations for nutritional supplementation or dietary purposes are gaining increased attention. Animal studies have shown that dietary phytochemical antioxidants are capable of removing free radicals. Free radicals are very reactive chemical species, eventually evoking uncontrolled reactions resulting in oxidative damage of important biological macromolecules. Radical scavenging antioxidants are particularly important in the antioxidative defense to protect cells from the injurious effects of free radicals. Among them, phenolic and polyphenolic compounds such as flavonoids in edible plants, exhibit potent antioxidant activities [2] [3]. They are found in many fruits, vegetables and grains in variable contents with high amounts being found in soybeans, soy products and red clover, and are reported to have beneficial estrogenic effects in the treatment of menopausal disorders and cardiovascular diseases and may lower the risk of several cancers. Soy beans and soy products are known as the richest sources of the two estrogenic active isoflavones genistein and daidzein.

Carrageenan, a colloidal extractive from algae is a galactose-containing polysaccharide used chiefly as a suspending agent in foods, pharmaceuticals, cosmetics and industrial liquids, as a clarifying agent for beverages and in controlling crystal growth in frozen confections. Ionizing radiation affects polysaccharides like carrageenan, widely used in food industry, through the modification of their rheological behavior [4] [5]. In this work soy isoflavone genistein was used in order to verify their capability as radiation protector in an in vitro system made of irradiated polysaccharides.

2. MATERIALS AND METHODS

2.1. Materials

Commercial kappa carrageenan samples from *Agar Brasileiro Ltda* were employed. Soy isoflavone purchase in market (soy concentrate extract rich in genistein).

2.2. Irradiation

Irradiations were performed in a Co-60 Gammacell 220 (AECL), dose rate 4.6 kGy/h with doses of 0, 1.0, 2.5, 5.0, 7.5 and 10.0 kGy dose uniformity factor: 1.13. For the irradiation, the samples were contained in 100 ml-glass tubes.

2.3. Viscosimetry

Viscosimetry techniques developed previously at the laboratory were applied (Aliste, A. J., 1999). A Brookfield viscometer, model LV-DVIII, spindle SC4-18, with an adapter ULA and a Neslab water bath model RTE-210, precision ± 0.1°C was employed. Carrageenan was prepared at 1% at about 100°C. For all the solutions soy isoflavone was added at last and to attain 0, 0.5, 1.0, 1.5 and 2.0g.ml^{-1} final concentrations. Viscosity measurements were the average of at least 3 determinations.

3. RESULTS AND DISCUSSION

The viscosity reduction of carrageenan solutions due to radiation effect was function of radiation dose and soy isoflavone concentration. When isoflavone was added to attain 2.0g.ml^{-1}, a decrease of 0%, 57%, 73% 78% and 83% in the viscosity was found, for irradiations dose respectively of 1, 2.5, 5, 7.5 and 10kGy. The decrease in viscosity was inversely proportional to the concentration soy isoflavone, showing a protection action of the aglicone for carrageenan solutions (table 1).

Table 1. Viscosity decreases from different doses of gamma irradiation and soy isoflavone concentrations.

	Soy isoflavone ($g.ml^{-1}$)				
Dose (kGy)	0	0.5	1.0	1.5	2.0
1.0	83	61	43	37	0
2.5	88	82	75	71	57
5.0	89	88	83	80	73
7.5	89	89	85	84	78
10.0	92	91	89	89	83

Fig. 1 presents the results of the viscosity variations in function of the dose, at 60ºC and an angular speed of 250 $rpm.min^{-1}$ for the carrageenan solutions. From these results, a progressive decrease of the viscosity is verified as a function of the applied radiation dose.

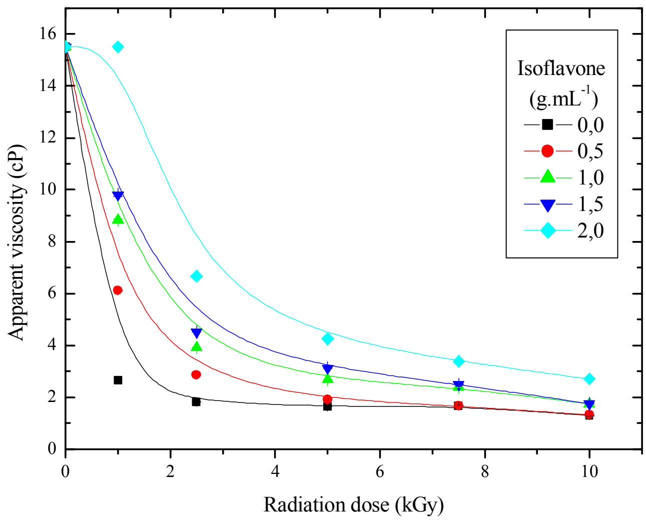

Figure 1. Radiation dose versus apparent viscosity from different isoflavone concentrations.

For the same irradiation dose the pH shows not to have an important effect in a decrease of viscosity solutions (table 2).

Table 2. pH in different doses of gamma irradiation and soy isoflavone concentrations.

	Soy isoflavone ($g.ml^{-1}$)				
	0	1	1.5	2.0	2.5
Dose (kGy)			**pH**		
0	7.32	6.44	7.39	7.52	8.12
1.0	6.70	8.04	6.10	8.04	7.89
2.5	6.41	7.38	8.11	6.84	6.97
5.0	4.60	6.34	6.54	6.53	6.57
7.5	3.93	5.89	6.21	6.41	6.52
10.0	3.66	5.95	6.54	6.59	6.42

3. CONCLUSIONS

Other complementary studies must be done; the results are promising in use soy isoflavone to protect a biological system from the danous effect of gamma radiation.

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