Effect of ^{60}Co gamma radiation on the levels of phenolic compounds from crude extracts of bark of *Spondias luta* L.

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ABSTRACT

Spondias luta L. (Anacardiaceae), popularly known as cajazeira, is a plant widespread in several regions of Brazil, famous for containing phenolic compounds, which are responsible for your characteristic astringent. Ionizing radiations have the ability to cross the material, ionizing atoms and molecules, causing changes in atoms and molecules important. It is known ionizing radiation promotes quantitative and qualitative changes in plant materials, increasing, decreasing or inactivating secondary substances. The objective of this work was to evaluate the effect of gamma radiation as a modifier of the activity of the phenolic compounds of the bark extract of *S. luta* L. Methods: For the dosage of phenol extracts (control, irradiated with 5 kGy, 10 kGy, 15 kGy and 20 kGy) were diluted in methanol to a final concentration of 200 mg / L. In test tubes were added 50 µL of extract plus 1 ml of distilled water and 500 µl of Folin (diluted 1:10). After 10 minutes in a dark chamber was added 2.5 ml of calcium carbonate to 20% and the content of the tube was homogenized. After 20 minutes was performed with a spectrophotometer at 735 nm. The assay was performed in triplicate and calculated from a standard curve solution of gallic acid and expressed in µEAG (GAE/mg extract). Results: The control extracts, irradiated to 5 kGy, 10 kGy, 15 kGy and 20 kGy, had, respectively, 6.25, 6.70, 6.25, 6.85, 6.45µEAG/mg of extract. Conclusion: The results showed no significant change in the amount of phenolic compounds, showing that these compounds are radioresistant extract these doses.

1 INTRODUCTION

Currently, there is a growing interest in medicinal plants as a potential source of new bioactive molecules agents. Thus, the bioactivity of the medicinal plants are inherent to a group of compounds called secondary metabolites. These are synthesized from catabolic, anabolic reactions and biotransformation from amino acids, carbohydrates

and lipids produced by the plant. Among the major secondary metabolites are phenolic compounds, which are characterized by varied biological activity [1- 3].

The knowledge and research of the benefits of plant species were performed by various civilizations on all continents. Although empirically or intuitive, based on random discoveries, ancient societies used the plants for therapeutic purposes, and later, they formed the basis for Botany, Chemistry and Medicine. And scientifically used as antibiotics. There is currently, a tendency to return to herbal medicine, attitude recommended by WHO - World Health Organization The national supported the study and use of medicinal plants as a regional form of lower costs of pubic health programs, particularly in countries underdeveloped or developing countries, such as Brazil [4].

Research of plant with therapeutic properties originate medicines with lower cost and therefore more accessible to the population, which, in most cases, is without any financial condition to afford the high costs of drugs, that may be used as part of meeting the needs of primary health [5].

Among these, the hog plum (*Spondias luta* L.), plant of the family *Anacardiaceae* Tropical America, is widespread in almost all parts of Brazil. Their structures are widely used in folk medicine and the pharmaceutical industry. The husks as aromatic, astringent and emetic, constituting a good emetic in cases of bilious fevers and marsh, enjoying the reputation of astringent, used against diarrhea, against diarrheia, gonorrhea and hemorrhoids, the latter property also attributed to the root [6]. The extracts of the leaves and branches of *Spondias luta* L. have medicinal properties for the control of gram positive and negative contained ellagitannins [7].

In the past there were exceptions to utilize products of plant origin, but it has been solved by the device of the process of gamma irradiation with ^{60}Co source, which is a physical process of heat treatment comparable to pasteurization, freezing or canning. However, the advent provides microbiological control, increased shelf life and storage chemical-physical treatment thereof, and be nontoxic [8-14].

Using this theory research, the aim of this study is to observe the behavior of crude extracts of bark of *Spondias luta* L. submited to ^{60}Co gamma radiation at doses of 5 kGy, 10 kGy, 15 kGy and 20 kGy, assessing the levels of total phenols.

2 METODOLOGY

2.1. Collection of samples

Barks of *Spondias luta* L. were collected in a fragment of savanna vegetation, with about 20 ha, within the "Empresa Pernambucana de Pesquisa Agropecuária" (IPA) Experimental Station, State of Pernambuco, Brazil (08°14'18 .2"S and 35º54'57.1 "W). The area is located circa 9 km northeast of the city of Caruaru, about 150 km from the state capital of Recife. This area was chosen due to the large number of specimens of the genre and offer good conditions of preservation.

2.2. Vegetable Extracts

The crude extract was obtained from the bark of *Spondias luta* L. by maceration for 72 hours on three consecutive extractions with ethanol/water 70%. Subsequently, the hydroalcoholic extracts were filtered and evaporated to dryness on a rotary evaporator Marconi (Model MA-120).

2.3. Irradiation of Extracts

The irradiation of the samples *Spondias luta* L. were placed in glass tubes and taken to Gammacell for irradiation with ^{60}Co source (model 220-Excel MDS Nordion, a dose rate of 10,040 kGy/h) from the Departmento de Energia Nuclear, Universidade Federal de Pernambuco. Irradiation at doses in kGy are the following: 5.0; 10.0; 15.0; 20.0.

2.4. Determination of total phenols

The measurement of total phenols was performed using the methodology of Singleton and Rossi (1965) with modifications where extracts were diluted in methanol to a concentration of 200 mg / L. In test tubes were added 50 mL of extracts, 1 mL of distilled water and 500µl Folin (diluted 1:10). After 10 minutes, 2.5 ml of sodium carbonate at 20% was added. After 20 minutes in a darkroom, the solution was read in a spectrophotometer at 735 nm. The assay was performed in triplicate and the results were calculated from a standard curve solution of gallic acid and expressed in µEAG (GAE/ mg extract. The equation of acid galic calibration was: $y= 0.0721x + 0.0278$ ($R^2 = 0.997$) [15-18].

2.5. Statistical Analyzes

The statical tests were performed using the program Prism 4.0, following by ANOVA and Student-Newman-Keuls test at a significance level of 5% ($p <0,05$).

3 RESULTS AND DISCUSSION

The figure 1 shows the graphs for the determination of total phenols using the hydroalcoholic extracts of barks of *Spondias luta* L. unirradiated and irradiated at doses of 5.0, 10.0, 15.0 and 20.0 kGy at concentration of 200 mg/L.

Tests for determination of phenols did not show significant changes, with values of 6.25 (± 0.2), 6.70 (± 0.5), 6.25 (± 0.5), 6.85 (± 0.4) and 6.45 (± 0.4) µEAG, respectively for control, and irradiated with 5.0, 10.0, 15.0 and 20.0 kGy.

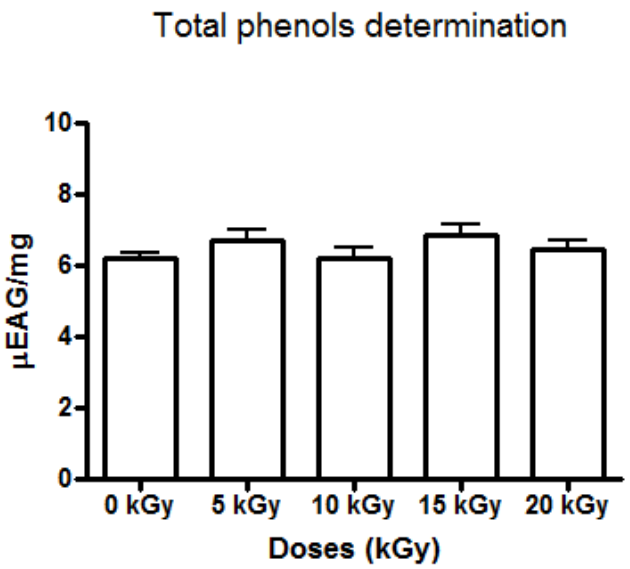

Figure 1. Total phenol content of bark of *Spondias luta* L, for control (0 kGy) and irradiated (5.0, 10.0, 15.0 and 20.0) (GraphPad Prism 4.0).

Several studies involving plant extracts showed that the ^{60}Co gamma radiation increased the concentrations of total polyphenols [19-24]. Santos et al, 2011 [24], studied extracts of bark and leaves of *Anacardium occintale* Linn., and found a significant increase ($p < 0.05$), dose-dependent between 0 kGy and 10 kGy in leaf extracts and without difference between extracts of bark. Therefore, it is clear that the ^{60}Co gamma radiation can act on plant materials peculiar to each species.

Silva and collaborators [25] stated in their study that phenolic compounds of *Ananas comosus*, after the irradiation process above 150 Gy, showed higher tannic acid, a type of polyphenol. Already Camargo and collaborators [26] observed a linear increase of phenolic compounds in peanuts at doses of 5.0, 7.5 and 10.0 kGy. At a dose of 15 kGy, it was observed that this increase is interrupted when the phenol content becomes lower than the control group. Villavincencio and collaborators [27] in their studies using beans "Carioca" and "Makassar", observed that there was a decrease in tannin content in raw and cooked grains.

Silva and Silva [25] indicated that the increase or decrease in the content of phenolic compounds can be give by increasing or decreasing the efficiency of extraction of these compounds through the radiation dose. Miranda and collaborators [21] further suggests that the increase or decrease in tannin contents, if the degradation gives a greater amount of lignin influenced by ionizing radiation.

Thus, comparing the various studies cited by the results obtained in this study, it is clear that the process of the ^{60}Co gamma radiation interacts with materials of plant origin, peculiar to each species.

4 CONCLUSION

The results showed that the ^{60}Co gamma radiation between 5 and 20 kGy not statistically influence, the content percentage of bark polyphenol of *Spondias luta* L.

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