Radiation modification of foamed articles based on cassava starch

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The products produced with conventional non-biodegradable synthetic polymers are considered inert to attack immediately of microorganisms. This property makes that these materials have a long lifetime and thus cause serious environmental problems since, after its disposal, on average take 100 years to break down completely, thereby increasing, every day, the amount of plastic garbage discarded in the environment.

The packaging made from biodegradable materials can be used to reduce the environmental impact caused by conventional packaging. The packages made from starch, for example, have good mechanical properties and a price competitive market, as well as being completely biodegradable.

The gamma irradiation has been known as a very convenient tool for the modification of polymer materials using techniques "crosslinking" (cured), grafting and degradation[1,2].

This work aims to study the mechanical properties of cassava starch in front of gamma radiation, for cobalt-60 (^{60}C0), when subjected to doses of 12kGy and 25kGy for the development of packaging, and compare the results to those of conventional packaging, as the expanded polystyrene (Styrofoam) and paper cards. The starch foams (packaging) were obtained by thermopressing process that consists in two parallel steel plates where starch dough (cassava starch, water and plasticizer) is processed to form a rigid structure by swelling, gelatinization and network formation. After baking, the foams were conditioned for one month at 23°C and 60% relative humidity (RH) before mechanical testing. Glycerin was selected as plasticizer and water was necessary for the preparation of the foams.

The mechanical and the barrier properties of starch foams are influenced by the irradiation dose. The packaging in which the cassava starch was subjected to irradiation had lower resistance to compression (18.5N, referring at doses of 12kGy and 25kGy) compared to that in which the starch has not been irradiated (36.8N). With regard to flexibility, the packaging with starch irradiated to 25kGy proved to be the most flexible (6.3mm), followed that with starch non-irradiated (3.9mm). The packaging with starch irradiated to 12kGy was less flexibility (3.1mm). After irradiation, the barrier properties of the foams with glycerin have good flexibility and low water permeability. The packaging of expanded polystyrene is the most resistant to compression (25N), followed by the packaging of cassava starch (21.8 N) and, finally, paper card (5N). The styrofoam is more flexible (8.43 mm) that the role cards (6.84 mm), which in turn is more flexible than a pack of starch (6.81 mm).

References

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