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Butyl rubber recycling by means of gamma radiation followed by mechanical shear

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Polymeric materials (plastics and rubbers) cover a continuously raising proportion of urban and industrial solid wastes discarded in landfills and consequently their impact on environment are more and more concern. Rubbers exhibit a very slow natural decomposition due to their chemical structure weather resistant as well to enzymatic degradation and to microorganisms. Rubber recovering is hampered by its insolubility caused by crosslinked structures. Besides, this tridimensional structure causes various problems for material recovering and reprocessing. Just 8% to 12% of polymeric residues are thermoplastic polymers; remaining are elastomers especially post consumption tires. It is relevant to emphasize that the crosslinking is essential for practical use of rubber and this process is worldwide known as vulcanizing process, discovered by North American Charles Goodyear. The implementation of new technologies in order to reduce polymeric residues, acceptable from the environmental viewpoint and at an effective cost proved to be a great problem due to inherent complexities for polymers reuse. Ionizing radiation has capacity to change structure and properties of polymeric materials. Butyl rubbers have been used in wide scale within a variety of applications such as tires spare-parts and diverse artifacts. Major effect of high energy photon, such as gamma rays in butyl and halo-butyl rubbers is the creation of free radicals accompanied by changes in mechanical properties. This work aims to the development of processes of controlled degradation (de-vulcanizing) of butyl rubber in order to characterize their availability for modification and changes of their properties. Experimental results obtained showed that butyl rubbers irradiated at 25 kGy and further sheared can be used as the starting point for mixtures with pristine rubber.

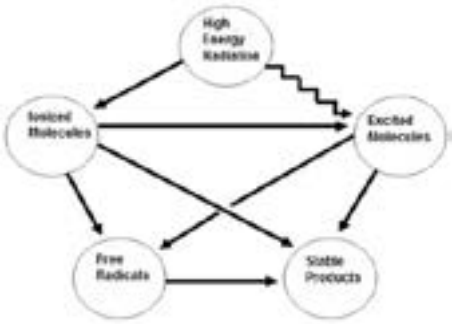

Figure 1: Radiation interaction products with atoms or molecules

Recent Publications

1. Scagliusi S R, Cardoso E C L and Lugão A B (2016) Study of recycling feasibility of bromobutyl rubber to gamma radiation. Journal of Materials Sciences and Applications 2:1-9.
2. Zaharescu T, Zen H A, Marinescu M, Scagliusi S R, Cardoso E C L and Lugão A B (2016) Prevention of degradation of γ-irradiated EPDM using phenolic antioxidants. Chemical Papers 70(4):495–504.
3. Scagliusi S R, Cardoso E C L, Parra D F, Lima L F C P and Lugão A B (2013) Evaluation of "Payne effect" in radiation-induced modification of chlorobutyl rubber. Radiation Physics and Chemistry 84:42-46.
4. Scagliusi S R, Cardoso E C L and Lugão A B (2012) Radiation-induced degradation of butyl rubber vulcanized by three different crosslinking systems 81(8):991-994.

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Biography

Sandra R Scagliusi has great experience with elastomers. She has upgraded in recovering of rubbers, in general, specially dealing with butyl and halo-butyl rubbers (chlorine and bromine). She is deeply involved with irradiation, recycling, de-vulcanization, and micro-wave. She developed a new process of rubbers recovering via radiation and mechanical shear. She has been dedicating in research toward environmental area in recycling of solid materials and elastomers. She has proved experience in research and quality control laboratories.

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