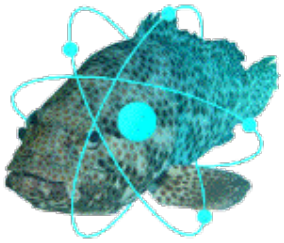

Contribution ID: **21** Type: **ORAL**

Ionizing radiation effects on polymer biodegradation

Wednesday 30 May 2018 15:50 (20 minutes)

The great properties of conventional synthetic plastics have allowed a wide range of applications. Packaging constitutes the larger market segment and, due to its specific function, it rapidly becomes waste that increasingly accumulates in the environment. Most of the conventional petrochemical-based plastics are not biodegradable and the production of biodegradable and bio-based plastics is still limited by the high production costs and the poorer properties. Nowadays efforts have been devoted to enhancing conventional plastic degradability and to tailor biodegradable polymer properties.
Finding a cost-effective and environmental-friendly solution for the treatment of plastic waste is extremely important. It is well known that ionizing radiation can modify polymers, affording many practical applications. In particular, gamma radiation can facilitate the material degradation by inducing oxidative fragmentations of polymer backbone. Experimental activities have been addressed to investigate if a radiation treatment of bio-based plastics could represent an effective pre-treatment to improve their biodegradation.
Commercial and synthesized polymers with different rate of biodegradability have been selected, such as polyethylene (PE) and the biodegradable polybutylene succinate (PBS). Polymer films have been irradiated by Co-60 sources in an industrial plant for sterilization and the impact on the rate of biodegradation in compost has been evaluated. Polymers have been irradiated at absorbed doses up to hundreds of kGy taking into account also the effect of different irradiation environments. Radiation-induced changes of the chemical properties have been evaluated as a function of the absorbed dose by means of different techniques in order to correlate their changes to the biodegradability in compost. In general, the degradability of the considered systems is increased in opportune irradiation conditions: by optimizing the irradiation process, a common environment of irradiation could be adopted for all the systems. The research performed confirmed that the radiation-induced degradation could be considered as an effective pre-treatment to enhance the biodegradation rate of some polymeric systems.

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Session Classification: Scientific

Track Classification: Scientific