



Nuclear
Sciences and
Applications

Radiation Technologies: Contributing to a Cleaner Environment and Better Health Care



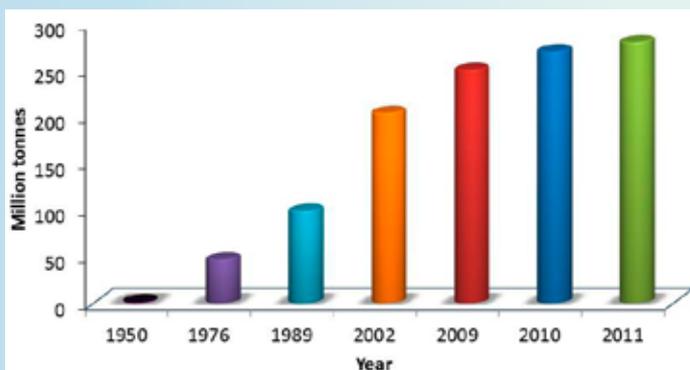
Avoiding trash in the ocean

Radioisotopes and radiation technologies, including radiation processing, radiotracers and nucleonic measurement systems, underpin a variety of industrial and environmental applications and contribute to the development of countries worldwide by providing environmentally friendly solutions. The Radioisotope Production and Radiation Technology Programme of the IAEA assists and advises Member States in assessing their needs for capacity building, research, development and deployment of environmentally sustainable technologies for socio-economic benefits.

Radiation processing technology, in combination with chemical processes, can contribute to processing natural polymers into biodegradable plastics leading to value-added products, thus reducing the impact on the environment.

Plastics – too much of a good thing?

Plastics, which are synthetic organic polymers, have made a profound impact on our lives for over 60 years. More than 100 million tonnes of plastic are produced in the world each year, of which about 10% ends up in the ocean. The option of recycling is restricted as products are made of components of different plastic types that make them hard to recycle. A technically and economically viable option is to develop fully biodegradable plastic materials using natural polymers that are non-toxic and renewable. Biodegradability is an additional functionality allowing cheap disposal of the item after it has fulfilled its job. These add-on qualities of being derived from renewable resources and being biodegradable can reduce the impact on the environment significantly.



Global production of plastics



Biodegradable plastics — the coming big wave

Starch, palm oil acrylates, chitosan and polylactic acid can be used to prepare non-toxic, biodegradable and renewable (recycled) products. Examples of useful biodegradable products are:

- Food packaging — packaging that can be composted together with its contents when the product is past its sell-by date or spoiled;
- Agricultural products — plastic sheeting that can be ploughed — into biodegradable mulch and seed films;
- Medical products — absorbable sutures; micro-devices containing medicine, which break down inside the body; hydrogel for wound dressing.

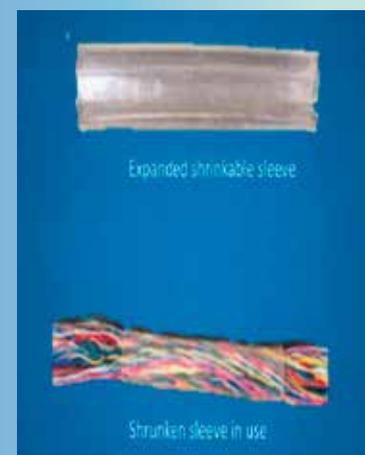


Radiation processed biodegradable plastics from natural polymers

Combined with chemical processes, radiation processing technology can be applied to modify natural polymers into value-added products. When the material is exposed to high energy radiation, it can undergo degradation or crosslinking, depending on the irradiation conditions. Natural polymers such as carboxymethyl cellulose or carboxymethyl starch can be crosslinked to form a hydrogel material to be used in the health and industrial sectors, while polylactic acid can be used for the production of heat-resistant cups and heat-shrink products.

Advantages of the technology:

- Use of a natural polymer as a ‘green’ polymer which is biocompatible, biodegradable, relatively cheap, abundant and easily available in many countries in the world;
- The process can change the chemical, physical or biological properties of the materials with no generation of radioactivity;
- The plastics formed are mechanically strong, flexible and transparent;
- Green process, effective and commercially attractive;
- Use of low irradiation doses: low cost — more economic.



Radiation processed polyactic acid based heat-shrink sleeve