IAEA

Nuclear Sciences and Applications

Securing A Better Future For All Nuclear Techniques for Global Development and Environmental Protection

Radioisotope Production and Radiation Technology

Contributing to Better Health Care and a Cleaner Environment

Radioisotope and radiation technology finds numerous applications in a wide variety of fields, most importantly in medicine, industry, agriculture and the environment. However, in order to take full advantage of the benefits offered by this technology, it is essential to provide the necessary infrastructure as well as qualified personnel. The IAEA strives to promote worldwide availability of products and facilities in order to offer the benefits of radioisotope products and radiation technology to developing countries. In particular, the IAEA helps Member States to achieve self-sufficiency in the production of radioisotopes and radiopharmaceuticals, strengthen quality assurance practices and regulatory compliance as well as facilitate human resources development. The multipronged need based approach includes providing advice, assistance and capacity building support for:

- Development, production and quality assurance of reactor and accelerator based medical isotopes and radiopharmaceuticals for both the diagnosis and treatment of diseases, especially cancer;
- Establishment of irradiation facilities and utilization of gamma radiation, electron beam and X ray technology for varied applications, including tackling pollutants, wastewater treatment, sterilization of medical products, disinfestation of food grains, and synthesis and characterization of advanced materials;
- Application of radiation and isotopes in industrial process management.

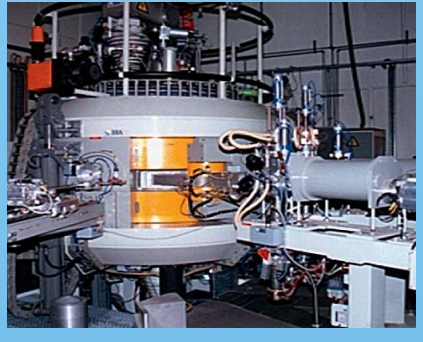
Facilitating the Supply of Molybdenum-99 (^{99}Mo) and Technetium-99m (^{99m}Tc)

The shortages in the supply of fission produced ^{99}Mo and ^{99m}Tc producing generators during 2007–2010 attracted international attention and directly affected patient care, since more than 30 million diagnostic investigations are carried out annually worldwide using ^{99m}Tc. In this context, the IAEA has been working towards ensuring the sustained supply of ^{99}Mo to all

Quick Facts

Diagnostic radiopharmaceuticals used in conjuction with modern medical imaging devices such as gamma camera and PET-CT scanners are used to diagnose specific pathological conditions such as cancer, cardiac disorders and neurological conditions much earlier than was previously possible.

Therapeutic radiopharmaceuticals, most often used in the treatment of cancers, are designed as ‘smart’ molecules to target cancerous cells and subject them to a payload of lethal dose radioactivity. On successful targeting, radiation damages the structure of the cancerous cells, thus creating a therapeutic effect and ultimately leading to complete destruction of the cancerous tissue.



Member States. While on the one hand coordination efforts with the OECD Nuclear Energy Agency to address the production and supply of ^{99}Mo on a large scale are expected to have a desirable outcome, the IAEA is also exploring alternative technologies for ^{99}Mo production. One promising example is the cyclotron based direct production of ^{99m}Tc proposed by Canadian researchers, which is being examined as a practical solution to at least partly alleviate shortages in countries that have cyclotrons available for use.

Enabling Wastewater Reuse Through Radiation Processing Technology

Chronic shortages of water in arid and semi-arid regions of the world and environmental policy regulations have stimulated the use of innovative technologies in treating wastewater for reuse for urban irrigation, gardens and parks, industry, cleaning purposes, etc. Standard biological processes commonly used for wastewater treatment are not capable of neutralizing many of the complex organic chemicals found in varying quantities in wastewaters.

Electron beam or gamma irradiation can treat such pollutants, transforming them into less harmful substances or reducing them to levels below permissible concentrations. On the industrial scale, the combined biological and electron beam treatment of wastewater from textile dyeing is in operation in the Republic of Korea, where more than 10 000 m^3 of wastewater is successfully treated per day. Based on this successful example of radiation treatment for water remediation, the IAEA has launched a coordinated research project to assist Member States in developing strategies to address the issue of wastewater treatment in their countries using electron beam or gamma radiation.

Optimizing Industrial Processes

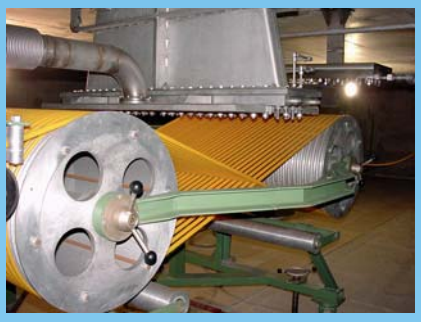
The oil and gas industry is vital in many Member States, and inspection of oil and gas pipelines to assess corrosion is necessary to ensure safety. Computed tomography (CT) using gamma rays is a rapid, sensitive and effective imaging technique increasingly used by industry to uncover corrosion and defects in the metal structure of pipelines. The IAEA has supported the development of simple transportable gamma CT systems in several Member States, such as Vietnam, primarily for oil and gas pipeline scanning.

Preserving and Protecting Our Past

For the past 40 years, radiation treatment has been successfully used in the preservation of a large variety of cultural heritage artifacts, such as furniture, statues, archaeological objects, ethnographic collections, mummies, books, leather, porous stones, tiles, mosaics, frescos and textiles. The IAEA assists Member States in developing and establishing radiation processing technology for preservation of their cultural heritage artifacts by setting up facilities as well as training personnel. Several Member States worldwide are using this technology in cooperation with conservators, curators and restorers to preserve the world's cultural heritage.

Quick Facts

Radiation processing technology, in which materials are exposed to ionizing radiation, is an additive-free treatment process that can improve the physical, chemical and biological properties of a material without generating radioactivity. The use of radiation in developing and studying polymer composites and nanostructured materials is an emerging and innovative area which has attracted the interest of many countries.



Ionizing radiation can be a powerful tool for the deactivation of microbes, either to address threats to public health and safety that might be posed by deliberate or inadvertent biohazard contamination, or to treat wastewaters for reuse in the industrial, agricultural and horticultural sectors, as well as for the preservation of cultural heritage artefacts.

Radiation treatment of volatile organic compounds and hazardous chemical agents can be highly effective in neutralizing harmful pollutants.

Radiotracers and non-destructive testing (NDT) aid immensely in improving productivity in terms of yield, quality and optimal energy utilization. Radiotracers have been extensively used in a wide variety of applications in the chemical industry, such as process optimization, troubleshooting, measurement of residence times at different stages in chemical processing, etc.