Editorial
Volume 12:2, 2021

Chemical Sciences Journal

ISSN: 2150-3494 Open Access

Editorial on Radiation chemistry

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Radiation chemistry is a branch of nuclear chemistry that studies the chemical effects of radiation on matter. It differs from radiochemistry in that the substance being chemically modified by the radiation does not need to contain radioactivity. The conversion of water to hydrogen gas and hydrogen peroxide is an example. Ionizing radiation deposits its energy by interacting with the electrons of the absorber as it passes through matter. The removal of an electron from an atom or molecular bond as a result of an interaction between the radiation and the absorbing species creates radicals and excited species. The radical species then react with each other and other molecules in their immediate vicinity. The reactions of radical species are responsible for the changes observed after a chemical system has been irradiated. Coulombic forces between the charges of the electrons in the receiving medium and the charged radiation particle interact with charged radiation species (and particles). These interactions proceed along the direction of the incident particle until the particle's kinetic energy is exhausted enough. Uncharged species (photons, x-rays) go through a single event per photon, for a total of one event. Electrons with enough energy interact with the absorbing medium in the same way as radiation does.

Equipment

Radiation chemistry applied in industrial processing equipment

A gamma source or an electron beam may be used to treat materials. The JS6300 and JS6500 gamma sterilisers (made by 'Nordion International, which used to trade as 'Atomic Energy of Canada Ltd) are examples of the international type IV (wet storage) irradiator.

Research equipment

Although certain forms of research can be performed with an irradiator similar to those used for gamma sterilization, a time resolved experiment in which a substance is exposed to a pulse of radiation is common in some fields of science (normally electrons from a LINAC). Following the pulse of radiation, emission spectroscopy or absorption spectroscopy is used to determine the concentration of various substances within the sample, allowing the rates of reactions to be estimated.

In the above experiment, the sample is excited by a pulse of light and spectroscopy is used to investigate the decay of the excited states, as well as the formation of new compounds. The effects of halogen-containing compounds on the ozone layer have been better understood thanks to flash photolysis experiments.

How to cite this article: *Raajitha Bellamkonda*. "Radiation Chemistry" *Chem Sci J* 12 (2021).

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Received 10 February 2021; **Accepted** 13 February 2021; **Published** 20 February 2021