**Radiation Chemistry Department**

Keeping the competence in the field of radiation chemistry is of strategic importance for the country and this is the mission of this department. The energy of ionizing radiation is used in various fields of the industry e.g. sterilization of medical products, food irradiation (shelf life extension), polymer processing.

The energy of ionizing radiation is utilised with high efficiency in polymer processing. The mechanical properties and thermal resistance of most of the polymers can be improved by radiation initiated crosslinking. In the last years using the same method superabsorbent natural polymer (cellulose derivative) based hydrogels were developed in the laboratory. These hydrogles can absorb several hundred times more water than their dry masses. Superabsorbents have found potential application in many fields such as agriculture, hygiene articles (diapers), wastewater treatment, and drug delivery carrier. The cellulose derivative based superabsorbents are excellent candidates for use in agriculture as soil conditioners. They absorb water during rainy season and release it during the drought. They have promising results in this field: when adding a small amount of their hydrogels to the soil the water retention of the soil was highly improved.

The laboratory is committed to the environmental protection, especially to the preservation of the quality of our fresh water recourses. The so called advanced oxidation processes (AOP) are developed (ozonation, Fenton reaction, photo-Fenton reaction, etc.) to remove biologically not degradable, so called recalcitrant compounds, e.g. pharmaceuticals, pesticides, health care products from water. By these techniques reactive species are produced and utilized for the destruction of toxic compounds dissolved in water. Ionizing radiation treatment belonging to AOP techniques has the advantage that it is working without any additive. This technique requires much less energy to destroy (mineralize) biologically not degradable compounds in water than other AOP. During irradiation treatment of aqueous solutions the water absorbs the energy of ionizing radiation, but its decomposition products (strongly oxidizing radicals) react with the solute by destroying the harmful molecules. Therefore the effect is highly magnified. Ionizing radiation is an effective tool for the improvement of the quality of drinking water.

The laboratory is well equipped with analytical devices first all for water and polymer analysis. These equipments are also used for educational purposes. The senior members of the laboratory give courses at the universities and organize for the students laboratory exercises. Several young people are working in the lab on their PhD theses.

**Selected publications:**

1. Sampa, M.H., Takacs, E., Gehringer, P., Rela, P.R., Ramirez, T., Amro, H., Bojanowska-Czajka, A., Botelho, M.L., Han, B., Solpan, D., Cooper, W., Emmi, S.S., Wojnarovits, L., Remediation of polluted waters and wastewater by radiation processing. Nukleonika, **52**, 137-144 (2007)

2. Emmi, S.S., Takács, E., Water Remediation by electron-beam treatment. In Radiation Chemistry, From Basics to Applications in Material and Life Sciences. Eds., Spotheim-Maurizot, M., Mostafavi, M., Douki, T., Belloni, J., EDP Sciences, Les Ulis Cedex A - France, ISBN 978-2-7598-0024-7, Ch. 6, 2008, 87-103.

3. Wojnárovits, L., Takács, E., Irradiation treatment of azo-dye containing wastewater: an overview. Radiat. Phys. Chem. 77, 225-244 (2008)

4. Wojnárovits, L., Földváry Cs., Takács E., Radiation-induced grafting of cellulose for adsorption of hazardous water pollutants. A review. Radiat. Phys. Chem. 79, 848-862 (2010)

5. Wojnárovits L., Radiation chemistry. In: Vértes A, Nagy S, Klencsár Z, Lovas R, Rösch F (szerk.). Handbook of Nuclear ChemistryHeidelberg; New York: Springer-Verlag, 2011. pp. 1267-1331.

6. Homlok, R., Takács, E., Wojnárovits, L., Degradation of organic molecules in advanced oxidation processes: Relation between chemical structure and degradability. Chemosphere 91, 383-389 (2013)

7. Gajda-Schrantz K., Arany E., Illés E., Szabó E., Pap Zs., Takács E., Wojnárovits L.:Advanced oxidation processes for ibuprofen removal and toxicological risk assessment of degradation intermediates. Ibuprofen: Clinical Pharmacology, Medical Uses and Adverse Effects. Editors, Wilton C. Carter and Brant R. Brown, Nova Science Publishers, 2013, pp. 152-232. (ISBN: 978-1-62618-659-0)

8. Sági, Gy., Csay, T., Takács, E., Szabó, L., Wojnárovits L., Analytical approaches to the OH radical induced degradation of sulfonamide antibiotics in dilute aqueous solutions. Journal of Pharmaceutical and Biomedical Analysis. Special issue on Pharmaceuticals in Environmental Media, Biota, Food Commodities and Work Place: Analytical Approaches. 106, 52-60 (2015)