Fraunhofer FEP

PRESS RELEASE

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Monitoring in electron beam based biotechnological processes by selective radiochromic liquid dosimeters

The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP is intensively working on low-energy electron beam processes in aqueous biosystems in the field of medical and biotechnological applications. The scientists have shown that low-energy accelerated electrons can both inactivate and stimulate microorganisms aqueous environments in a dose-dependent manner. The dose is an important process variable and a measure of the effects caused by accelerated electrons in the liquid, which is quantified by dosimeters. The Fraunhofer FEP is developing radiochromic liquid dosimeters for different dose ranges in order to be able to determine the absorbed dose in a liquid during electron beam processes for biotechnological fields of applications. These will be presented at Medtec LIVE with T4M, May 23-25, 2023, in Nuremberg, at the Fraunhofer FEP booth, no. 1-558.

The applications for low-energy non-thermal electron beam technology are diverse. One success story is the inactivation of bacteria and viruses for the chemical-free production of inactivated vaccines. In addition, the potential applications also extend to ecologically relevant issues, such as the biotechnological extraction of resources or the provision of energy sources. To this end the scientists at the Fraunhofer FEP are exploiting of the chemical and biological effects of low-energy accelerated electrons in liquids. Liquid dosimetry for selective process monitoring plays a major role here.

Currently used routine dosimeters are available as films and have limited suitability for dose measurement in electron beam processes in aqueous systems. A challenge in the use of low-energy electron beam technology is the low penetration depth of the low-energy accelerated electrons into the material, resulting in a dose gradient that must be taken into account when selecting the dosimeter.

Recognizing the high added value of low-energy electron beam technology for the fields of life science, biotechnology and environmental protection, the scientists at Fraunhofer the FEP have developed innovative approaches to liquid dosimetry, particularly in the low-dose range. The focus is on chemical liquid dosimeters that show a dose-dependent color change or decolorization due to the use of radiochromic substances. The color indicators can be easily and quickly evaluated using optical measurement methods. The scalable, radiochromic liquid dosimeters indicate the average dose of the total volume of the liquid. In addition, the Fraunhofer FEP is developing dosimeter systems based on microscopically small beads for medical and biotechnological

Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP
Winterbergstraße 28 | 01277 Dresden, Germany | www.fep.fraunhofer.de

Head of Marketing: Ines Schedwill | Phone +49 351 8823-238 | ines.schedwill@fep.fraunhofer.de

Head of Corporate Communications: Annett Arnold, M.Sc. | Phone +49 351 2586-333 | annett.arnold@fep.fraunhofer.de

applications. These are used for real-time dosimetry in low-energy electron beam processes of liquids. It is even possible to measure the dose distribution in situ in aqueous systems.

As part of her doctoral thesis in the field of medical and biotechnological applications, Joana Besecke is intensively researching into the development of new dosimeter systems for use in biotechnological production processes, using electron beam technology in an integrated manner for process optimization:

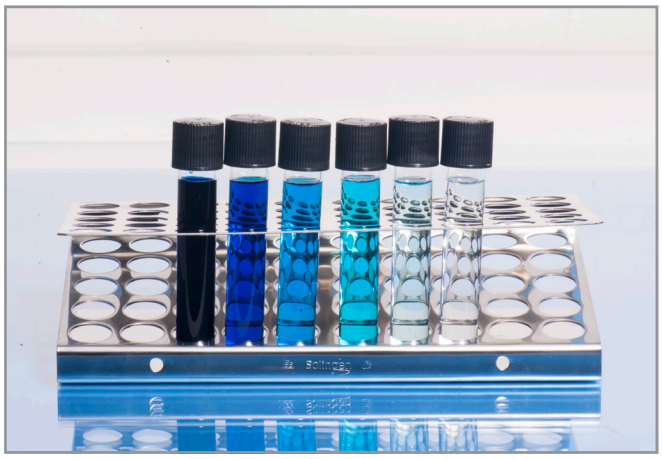
"We have succeeded in reproducibly establishing a series of radiochromic liquid dosimeters covering a variable dose range from 0.1 to 40 kilogray. It is crucial that liquid dosimeters are suitable both low and high doses. Only in this way are can effectively use the dosimeters in research projects for various biotechnological applications".

Dr. Simone Schopf, Head of the Biotechnological Processes group in the Division Medical and Biotechnological Applications at Fraunhofer FEP, adds: "Our long-term goal is to produce sustainable liquid dosimeters for low-energy electron beam technology that are compatible with the targeted applications in life sciences, biotechnology and the environment. This is the only way they can ultimately be used as inline-capable liquid dosimeters". For the targeted fields of application in life science, biotechnology and the environment. Because only in this way they be used as inline-capable liquid dosimeters".

With these tailor-made dosimeter systems, scientists at Fraunhofer FEP are able to selectively monitor the absorbed dose in aqueous systems and adapt them to various biotechnological application scenarios. Together with partners from industry and research, customized dosimeters for low-energy accelerated electrons are to be developed.

Fraunhofer FEP at Medtec LIVE with T4M 2023

May, 23 – 25, 2023
Nuremberg, Germany
Booth no. 1-558
www.medteclive.com



Process monitoring by selective radiochromic liquid dosimeters
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