I/2026

POCEK

POCEK BULLETIN

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Development of application potential in the field of polymeric materials in the context of fulfilling the principles of the circular economy (POCEK)

The POCEK project has actively promoted itself at major national and international events in recent months. Participating in these events has allowed us to present the project's goals, establish new contacts, and strengthen collaboration with experts from both academia and industry. The POCEK project's positive direction is also demonstrated by its new technological solutions, which have high application potential and a positive impact on the environment.

SCIENTIFIC OUTPUTS AND NEW INSIGHTS

In the second half of 2025, the project submitted four international and two national grant applications, reflecting the team's intensive project activity. Two functional prototypes were implemented, and a total of 10 research articles were published in high-impact international journals. Selected articles are discussed in more detail in the following chapter.

REMOVAL OF METHYLENE BLUE AND CONGO RED DYES FROM WASTEWATER USING ACTIVATED CARBON MADE FROM POLYESTER WASTE

An international team comprising three research institutions published an article on the removal of dyes from wastewater in the *Journal of Industrial and Engineering Chemistry*. The scientific study demonstrated that activated carbon produced from polyester waste using $ZnCl_2$ is a highly effective adsorbent for removing methylene blue and Congo red dyes from wastewater, achieving removal efficiencies of up to 100% and 99%, respectively, under optimized conditions.

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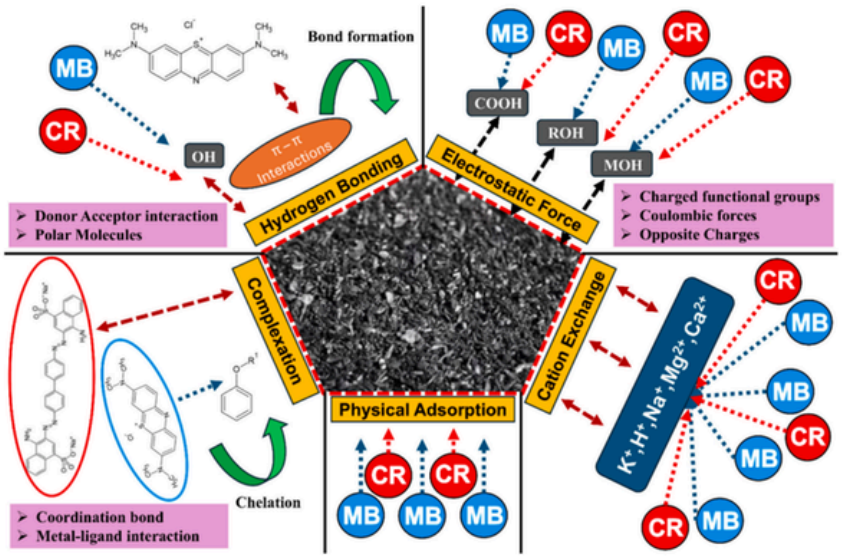
Adsorption occurs primarily via chemisorption mechanisms and is well described by a pseudo-second-order kinetic model; MB follows the Langmuir isotherm, while CR conforms to both the Langmuir and Freundlich models. Thermodynamic analysis revealed exothermic adsorption of MB and endothermic adsorption of CR, and the material maintains high efficiency even after several cycles of use, confirming its potential as a sustainable adsorbent for wastewater treatment.

For more information about the article, visit: https://doi.org/10.1016/j.jiec.2025.07.015



Possible mechanisms of interaction between MB and CR dyes and AC

THE IMPACT OF BIODEGRADABLE MICROPLASTICS ON SOIL: CHANGES IN MICROBIAL DIVERSITY AND NITROGEN MINERALIZATION

An article published in *Chemical and Biological Technologies in Agriculture* examined the impact of poly-3-hydroxybutyrate on soil microbial diversity. The study showed that poly-3-hydroxybutyrate (P3HB) microplastics significantly affect the soil environment by altering the structure of microbial communities, increasing microbial respiration and carbon turnover, and simultaneously reducing nitrate availability. The presence of P3HB promotes certain groups of fungi and bacteria that degrade organic matter but inhibits nitrifying microorganisms, thereby disrupting the nitrogen cycle in the soil. These changes lead to lower availability of mineral nitrogen and, consequently, reduced maize growth, with negative effects being particularly pronounced when soil contamination with P3HB microplastics exceeds 1%.

For more information about the article, visit: https://doi.org/10.1186/s40538-025-00814-x

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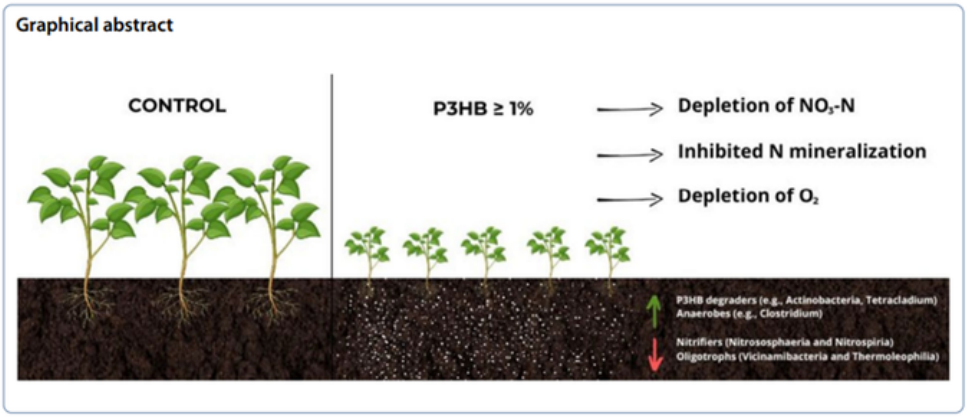
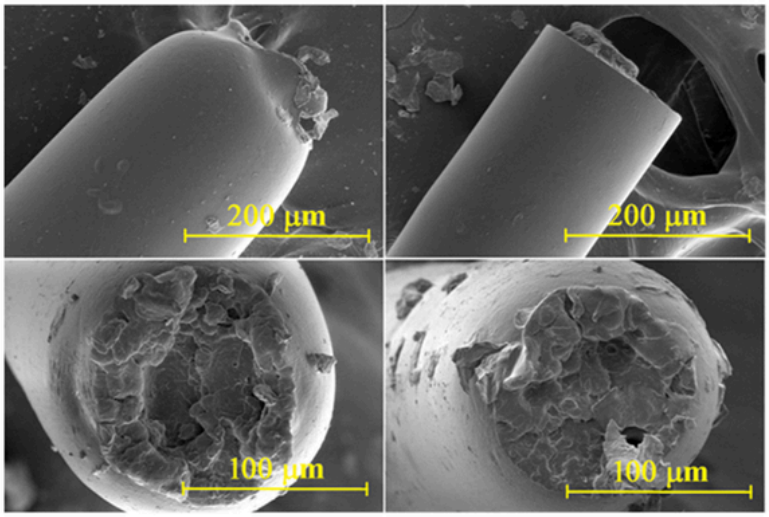


Graphic abstract of the article

FINDING NEW APPROACHES TO THE MECHANICAL RECYCLING OF TEXTILE FIBERS

A team comprising two research institutions (the Center for Polymer Systems and INOTEX, s.r.o.) addressed the issue of mechanical recycling of textile yarns in the international journal *Polymers*. Their study focused on the mechanical recycling of PA66 polyamide yarn and the effect of additives (Joncryl and Irganox) on its properties. The results showed that these additives increase the thermal stability, viscosity, and mechanical strength of the recycled material, with viscosity potentially increasing by up to 50%. Analyses also demonstrated changes in the polymer structure and the formation of new bonds during recycling. Although the Young's modulus decreased after the first cycle, further processing led to its improvement. The study confirms that the use of these additives can effectively mitigate degradation processes and promote the sustainable recycling of polyamide textile yarns.

For more information about the article, visit: https://doi.org/10.1016/j.jiec.2025.07.015



Scanning electron microscope images of a fiber that has been reprocessed twice (left) and a fiber that has been reprocessed once (right)

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INDUSTRIAL COUNCIL

The POCEK Project Industrial Council was established as a key advisory and strategic body composed of experts with extensive experience in both academia and industry. It is chaired by Prof. Vladimír Sedlařík, Ph.D., whose expertise and long-standing experience in materials research ensure the high quality and direction of the project's activities.

The Council also includes Ing. Ivana Bartoníková, Ing. David Hausner, Ing. David Klobáska, Ing. Milan Kopeček, Ing. Miroslav Minařík, Ing. Lukáš Trčka, Ph.D., doc. Ing. Vojtěch Stehel, MBA, PhD., and Ing. Čestmír Vančura. These members represent leading institutions and companies whose professional expertise and strategic insights are essential for the project's effective development and successful practical implementation. Together, they create a strong platform for linking science, research, and innovation with the needs of industry, thereby strengthening the overall impact of the POCEK project.

POLYESTER AND POLYAMIDE NANOFIBERS MADE FROM RECYCLED TEXTILE MATERIAL HAVE BEEN SUCCESSFULLY REGISTERED AS A FUNCTIONAL SAMPLE

As part of the project, a research team led by Dr. Petra Drohsler developed a functional prototype focused on nanofibers produced from precipitated waste textile fibers derived from primary waste. These are the most commonly used polymeric materials in this industry, specifically polyamide 66 (nylon) and polyester. The recycling process begins with precipitation, which allows for the removal of composite materials, additives, and fillers. During this process, the chemical properties of neither polymer matrix are altered; on the contrary, thermal stability is improved.

One of the advantages of this process for producing nanofibers is the ability to carry it out at laboratory temperatures. The materials are then processed into nanofiber textiles using the electrospinning method, where the process is optimized. Nanofiber materials prepared in this way differ primarily in their hygroscopic properties—polyamide nanofibers are highly hydrophilic, whereas polyester nanofibers are highly hydrophobic. These materials are currently in demand not only in the textile industry but also in many other sectors, such as healthcare and filtration systems.

POCEK PROJECT PRESENTATION

The project is regularly presented in the Czech Republic and abroad at scientific conferences, trade fairs, and workshops. Abroad, the project was presented in October at the EAI FABULOUS 2025 9th EAI International Conference on Future Access Enablers of Ubiquitous and Intelligent Infrastructures in Slovakia, in Canada as part of the Czech Mission on Environment & Emergencies, and in November in Thailand at the EAPSE 2025 conference. In February of this year, the project was presented in Brussels as part of the Bio-based Industries Consortium.

In the Czech Republic, the project was presented at the International Engineering Fair in Brno, in Prague at a workshop titled “Partnership for Agroecology,” and also during a twinning activity as part of the 15th meeting of the Zlín Region’s innovation infrastructure platform, ZLINNOVATION. It was also presented during a workshop of the PolyEnvi21 project—National Centers of Competence, Polymer Materials and Technologies for the 21st Century—and as part of a specialized workshop on Technology Transfer at the Tomas Bata University in Zlín. In February of this year, it was presented to participants at CrisKa 2026 in Uherské Hradiště.

UPCOMING EVENTS - PLASTKO 2026

The PLASTKO 2026 Conference, organized by the Center for Polymer Systems at TBU in Zlín, the TBU Technology Transfer Center, and the Plastics Cluster, will take place on April 22–23, 2026, at the U18 Education Complex in Zlín. It will offer participants a diverse program featuring plenary and technical presentations, poster presentations on flexible exhibition spaces, an electronic proceedings volume, the distribution of informational and promotional materials, and a social evening featuring cimbalom music.

This is a major event connecting science, research, and practice in the field of polymers and the plastics industry, intended for industry professionals, researchers, students, and innovators. The participation fee is 6,990 CZK excluding VAT, and more information is available at www.cps.utb.cz/plastko2026

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