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TECHNOLOGY Brief

Advanced Thiol-Functionalized Clay–Biochar Adsorbent for Heavy Metal Removal

A novel composite adsorption technology designed for selective heavy metal adsorption in contaminated water and soil

Technology Transfer Contact

Katarína Velková

Technology Transfer Office

Developed at Institute of Inorganic Chemistry and Institute of Civil Engineering and Architecture at SAS



+421 910 245 531

katarina.velkova@savba.sk

www.sav.sk

MARKET NEED

Manufacturers of adsorption materials continuously seek differentiated products that offer improved performance in demanding environmental applications while remaining compatible with scalable manufacturing and existing product portfolios. Although activated carbon, mineral adsorbents and ion-exchange materials are well established, there remains demand for selective adsorbents capable of targeting heavy metals in complex aqueous and soil environments. This is particularly relevant for manufacturers looking to expand their portfolio with next-generation adsorbents for industrial water treatment, remediation and mining applications.

TECHNOLOGY OVERVIEW

The technology is based on a novel thiol-functionalized **clay-biochar composite** adsorbent specifically designed for **selective removal of heavy metals from contaminated water and soil**.

Unlike conventional adsorbents that rely on a single material phase, this solution combines: **clay minerals + biochar + thiol (-SH) functional groups** into **one homogeneous composite material**, designed to support selective adsorption of heavy metals .



Heavily contaminated soil across European continent

VALUE FOR ADSORBENT MANUFACTURERS

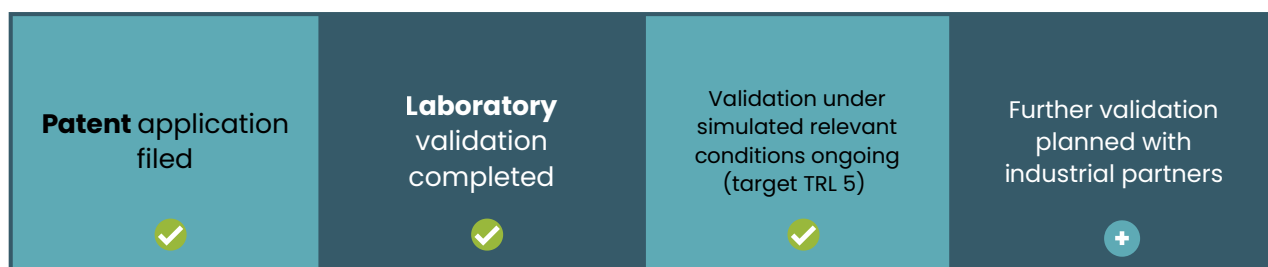
- **A differentiated adsorbent platform rather than another modified single-phase material.** The technology combines mineral and carbon adsorption mechanisms within one functionalized composite, providing a differentiated composite platform beyond conventional single-phase adsorbents.
- **Designed for selective heavy metal adsorption.** The composite is designed to target heavy metals, particularly those with a high affinity for thiol functional groups, through thiol functionalities integrated within the composite structure.
- **Opportunity for product differentiation.** The composite architecture and preparation method provide a technically differentiated solution that may support development of new specialised adsorption products with enhanced selectivity for heavy metals.



The solution is applicable in industry, especially in the field of remediation of contaminated areas and water treatment.

- **Compatible with existing adsorbent manufacturing expertise.** The technology utilizes readily available mineral and carbon-based raw materials and follows processing steps suitable for further scale-up.
- **Opportunity to expand existing product portfolios.** The platform may complement existing activated carbon, mineral adsorbent or speciality sorbent product lines targeting industrial wastewater, mining, remediation and environmental applications.

EVIDENCE PACKAGE



WHY PARTNER WITH US?

By partnering with us, companies gain access to an **innovative** adsorption **technology** with the potential to improve **heavy metal removal efficiency** while supporting sustainable **environmental remediation solutions**.

*Experimental data are available for evaluation under confidentiality

OPPORTUNITY FOR COLLABORATION

We are seeking industrial partners to support the **further validation, development and commercialization** of this novel heavy metal adsorbent technology, with licensing representing one potential pathway for bringing the technology to market.

- further technology validation under relevant industrial conditions
- **pilot-scale testing** and performance evaluation
- **joint development** and technology optimization
- validation for **environmental remediation applications**
- validation for **industrial wastewater treatment**
- **commercialization** partnerships, including potential **licensing**

FURTHER RESEARCH & INNOVATION COLLABORATION OPPORTUNITIES

The Slovak Academy of Sciences (SAS) offers partners research collaboration in energy and environmental technologies, with expertise in advanced materials, water treatment, adsorption and environmental remediation. SAS research teams specialize in the development and optimization of **sorbents, functionalized clays, biochar-based composites and water-treatment materials, as well as photocatalytic technologies, environmental monitoring and microbial contaminant degradation**.

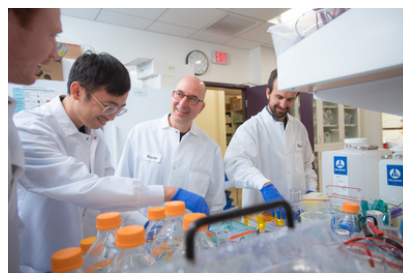
Cooperation can be tailored to the objectives of each partner and may take the form of **commissioned research, joint R&D projects, expert consultations, testing and analytical services, or technology licensing**.

The Technology Transfer Office of SAS (TTO SAS) serves as a central point of contact for companies. We help identify the most suitable research teams and expertise within SAS, facilitate connections with relevant institutes, support the definition of potential cooperation models and assist with contractual and technology-transfer processes.

ADDITIONAL R&D CAPABILITIES & TECHNOLOGIES

Our research capabilities include:

- **Development of sorbents and decontamination** materials based on organomodified clays, geopolymers, biochar-functionalized materials and advanced composites.
- **Testing and optimization** of materials for the removal of heavy metals, radionuclides, pesticides, pharmaceutical residues and other environmental contaminants.
- **Functional clay nanomaterials and surface modification**, including modified smectites, organoclays and layered silicates for tailored material properties.
- **Water-treatment materials** and functional surfaces, including porous membranes and photocatalytic materials for the removal of micropollutants.



ADDITIONAL ADSORBENT TECHNOLOGY IN DEVELOPMENT

PectoSil is a functionalized **silica-pectin hybrid adsorbent** being developed for the removal of metal cations from water. The material has demonstrated increased adsorption of selected metals in laboratory model solutions, with particular potential for the **polishing of industrial waters containing zinc and potentially copper**.

The technology is currently at an early development stage. We are seeking for **joint or commissioned R&D, validation using real industrial waters and application-specific product development**, with potential subsequent licensing or other technology-transfer arrangements.

