Special Issue

Engineering the Loop: Advancing Wastewater Treatment and Sludge Valorization Through Innovative Separation Materials

Message from the Guest Editors

Wastewater and sludge treatment technologies have advanced significantly as a result of the adoption of the circular economy framework. Waste-derived products like bio-based adsorbents, hydrogels, alginate, EPSs, and PHAs are now used as sustainable alternatives to traditional treatment agents. These materials effectively remove pollutants and stabilize sludge, leveraging high adsorption, biodegradability, and adjustable structures. These waste-derived products have enormous potential for secondary uses beyond their primary treatment roles. For example, EPSs and PHAs have the potential to be used in the production of biodegradable composites for packaging and in civil engineering sectors, while treated sludge enhanced with functional biopolymers can be used as soil amendments in agriculture. These materials can also help create reactive barriers and sophisticated filtration systems for industrial water treatment. In addition to improving the effectiveness of sludge and water treatment procedures, this all-encompassing strategy aids in sustainable resource recovery, lessens environmental impacts, and fosters the growth of a truly circular economy across a number of industries.

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