Abstract

Huge amounts of wastewater in low and lower-middle-income countries is released into the environment in untreated forms due to an increase in anthropogenic activities and disposal in water bodies. Pollution in water ecosystems results in water scarcity and crisis if effective and sustainable water treatment technologies are not adopted. Due to their abundance, cost-effective synthesis, and high contaminant removal capacities, zeolites have been considered as green and effective wastewater remediation materials. This paper presents an overview of the methods of synthesis, types, and efficiencies of zeolitic materials reported in wastewater remediation. In a state-of-the-art review, the latest data, discussion, conclusions, recommendations, and future perspectives are presented. In summary, synthetic zeolites are preferable in wastewater remediation because their structural characteristics can be fine-tuned at synthesis. In addition, synthetic zeolites can be tailored to remove specific contaminants based on ionic size, charge or type. The most common method of zeolite synthesis that has been reported is hydrothermal synthesis, which simulates the natural conditions of formation of zeolites. It is however not environmentally friendly due to large quantities of solvent- based byproducts. Recent methods utilize microwave radiation and solid-state synthesis methods to achieve green high-yield zeolites to be utilized in wastewater remediation. These materials are applicable in the removal of heavy metals, organic pollutants, and dyes, among others. The removal of these and other pollutants cost-effectively, sustainably, and efficiently is a great step toward a sustainable blue and green economy.