ABSTRACT

Presence of heavy metals in water bodies has been a concerning issue as well as a major threat to aquatic life due to their persistent, toxic as well as bio-accumulative nature. Although traditional wastewater treatment methods are effective but they are most often costly, energy consuming and related to secondary pollution. That is why the requirement for environmentally friendly, cost-effective, and sustainable options has gained significant momentum. In this study, an efficient rhamnogalactan polysaccharide-based mucilage was derived from *Alyssum homolocarpum* seeds and evaluated for its efficiency in the uptake of copper and nickel ions. the mucilage was extracted from the seeds, dried and stored and later on it was subjected to several characterization analysis comprising Infrared spectroscopy (FTIR), X-ray diffraction (XRD) and Field Emission Scanning electron microscopy hyphenated with Electron dispersive X-ray spectroscopy (FESEM-EDX) which confirmed the availability of functional groups (carboxyl, hydroxyl etc.), amorphous and semi-crystalline nature and porous and heterogenous morphology, respectively. EDX results further revealed the elemental composition of the novel mucilage, showing its enriched nature in carbon and oxygen elements, particularly due to the polysaccharide nature of the mucilage. A series of batch adsorption experiments was carried out to study the effect of contact time, pH. adsorbent dosage as well as the effect of initial metal concentration, which played a significant role in the removal percentage %R of efficient adsorbent. The conclusions of the above-mentioned findings prove the *Alyssum homolocarpum* seed mucilage as a strong, promising, sustainable, cost-effective, and eco-friendly candidate as a n efficient removal of heavy metals from wastewater. Furthermore, the natural abundance, presence of oxygenated functional groups along with the biodegradable nature of the *Alyssum homolocarpum* mucilage, makes it valid substitute of conventional chemical-based adsorbents. The future horizons of this mucilage may comprise on regeneration cycles for environmental remediation, column studies as well as its applications in drug delivery to further ensure the quality, efficiency, and commercial viability.