

Bio-based metal ion adsorbents: basic concept and applications

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Metal adsorbents for the recovery of valuable metal ions or for the removal of toxic metal ions are mostly composed of organic synthetic polymers. However, the development of green techniques avoiding the use of petrochemicals are necessary to realize a low-carbon society.

We have developed novel metal adsorbents composed of bio-based materials, cellulose and proteins. Many kinds of metal-binding proteins and peptides are reported in nature or by directed molecular evolution methods. However, proteins and peptide are usually dissolved in water and cannot be used for metal ion recovery from aqueous solution. Therefore, we tried to immobilize metal-binding proteins/peptides on water-insoluble cellulose via carbohydrate binding module (CBM), which is known to bind to cellulose. We constructed fusion proteins composed of metal-binding proteins/peptides and CBM, where a metal-binding part of the fusion proteins is variable or modifiable depending on target metal ions including Ni^{2+} , Co^{2+} , Au^{3+} , and hazardous heavy metals. The fusion proteins were strongly adsorbed on cellulose and could be used for metal ion recover from aqueous solution. The present versatile metal adsorption system employing biomolecules can be used for green and next generation metal recovery technique.

Keywords: Biosorption, Cellulose, Green sustainable materials

Bio-based metal adsorbents composed of protein and cellulose

