

Alginate Based Nano Composites for the Removal of Heavy Metals



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Abstract

It is essential to remove toxic and carcinogenic heavy metals from wastewater in order to avoid water pollution. This review paper presents the overview for the performance of various Alginate based nano composites explored for the sequestration of various toxic heavy metals such as Pb(II), Cu(II), Cd(II), Ni(II), Co(II), Cr(II) and Cr(VI). The reports of various literature survey revealed that the alginate based nano composite is an excellent material as an adsorbent for the removal of heavy metals.

Keywords: Heavy metals; Alginate; Nano composite

Introduction

Heavy metals discharged from various industries like electroplating, leather tanning, paint, textile and dyeing units are the primary cause of water pollution [1]. They pose serious threats to public health and environment due to their high toxicity, bio accumulative and non-biodegradable behavior [1,2]. Therefore, Water purification is emerging as a critical need for the researchers owing to the increasing globalization and urbanization [3].

In recent years, adsorption process has received utmost attention in the field of wastewater treatment [4,5]. Based on practical utility and economy, the development of low-cost and eco friendly adsorbents has attracted extensive interest to the researchers all over the world. Nano composites offers excellent template for the removal of heavy metals due their high specific surface area, small size, and quantum size effect [1]. The prefix 'nano' indicates one billionth or 10^{-9} units [6,7]. They are the materials whose components are mixed at nm scale [1].

Various types of biopolymers have been utilized for the removal of heavy metals such as chitosan, cellulose, alginate, dextrin, xanthan gum etc. [8,9]. But among various biopolymers, alginate has displayed an obvious efficiency as a biopolymer for the synthesis of biopolymer based nano composites [10]. Sodium alginate is a water soluble linear natural polysaccharide derived from marine plants [1]. It is composed of alternating blocks of 1-4 linked α -L-guluronic and β -D-mannuronic acid

residues [1]. It has excellent hydrophilicity, binding ability, low-cost, non-toxic, biocompatibility and renewability [10]. Mainly due to their biocompatibility and low-cost compared to other polymeric materials, alginate based nano composites have been widely explored for the water treatment [3,11].

Discussion

Various cost effective alginate based adsorbents have been reported that has been successfully explored for the removal

of toxic and carcinogenic heavy metals. Some of the excellent studies have been reported here. Synthesis of silica modified calcium alginate- xanthan gum hybrid bead composites for the removal of Pb(II) from aqueous solution has been reported [12]. The synthesis of Alginate-grapheme oxide hybrid gel beads for Cu(II) removal from aqueous solution has also been reported [13]. Another research revealed the synthesis of Alginate-alumina-collagen fiber adsorbent for the removal of Cu(II), Cd(II) and Pb(II) from aqueous solution [4]. Another study reported the synthesis of Alginate-betonies for the removal of Pb(II), Cd(II) and Ni(II) from aqueous solution [13]. The synthesis of novel sodium alginate supported tetrasodiumthiacalix [4] arenetetrasulfonatenanogel for adsorption of Cu(II), Cd(II), Pb(II), Co(II), Ni(II) and Cr(II) was also reported [8]. Another study revealed the synthesis of Methionine-modified betonies/ Alginate bio nano composite for Pb(II) and Cd(II) removal from aqueous solution [14]. Another study was reported for the synthesis of Halloysite/

Alginate nano composite beads for Pb(II) adsorption [15]. Another synthesis of Chitosan/ Alginate nano composite for the removal of Cr(VI) from wastewater was also reported [1]. Synthesis of Alginate-Au-Mica bio nano composite for the removal of Pb(II) and Cu(II) from aqueous solution was also reported [16].

Conclusion

Water contamination has always been a major problem due to rapid industrialization and globalization. There has always been a need for eco friendly approach for remediation of wastewater from toxic and carcinogenic heavy metals. Biopolymers based nano composite offers extensive help in removing heavy metals from wastewater. The literature survey revealed that Alginate based nano composite has been proved to be an excellent adsorbent in removing toxic heavy metals from wastewater. Hence, the synthesis of Alginate based nano composite appears to be the cost effective and simple alternative for the removal of heavy metals.

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