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Acrylamide grafted chitosan based ion imprinted polymer for the recovery of cadmium from Nickel -Cadmium battery waste

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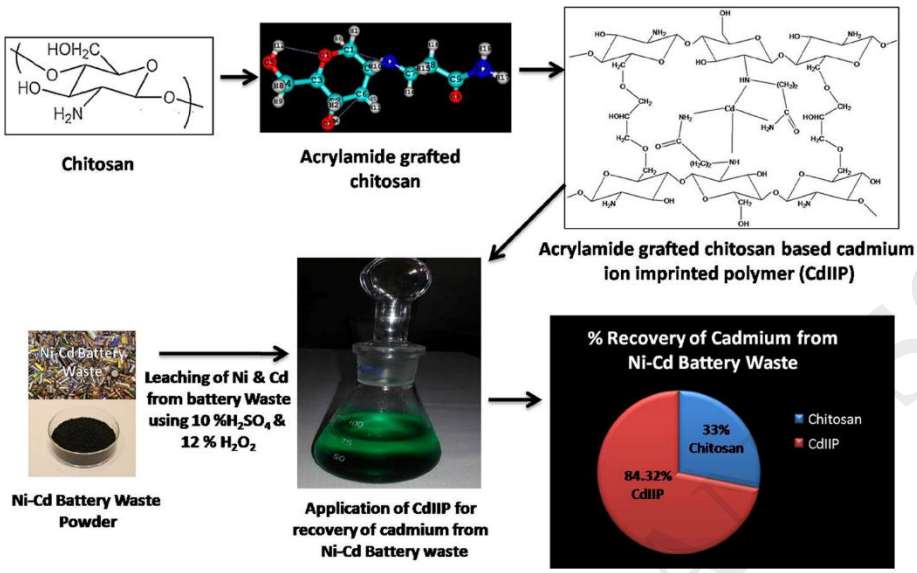
Graphical Abstract



Highlights

- Use of novel acrylamide grafted chitosan based cadmium ion imprinted polymer for the selective recovery of Cd from Ni-Cd battery waste.
- Molecular modeling for the selection of suitable grafting agent for functionalisation of chitosan
- Sustainable resource recovery method using ion imprinted polymer for the recycling of Ni-Cd battery waste.
- 84.3% of cadmium recovery from the Ni-Cd battery waste.

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Abstract

Spent Nickel cadmium (Ni-Cd) batteries are classified as hazardous waste due to the presence of toxic cadmium (Cd). Sustainable solution to this problem can be adoption of resource recovery methods for the reuse of Cd. This has been attempted in the present work using the biopolymer chitosan having inherent affinity for metals. Stability of chitosan in acidic medium was improved by grafting it with a suitable grafting agent and crosslinking. Further, it was used for the synthesis of acrylamide grafted chitosan based Cd ion imprinted polymer (CdIIP) using Cd as template and epichlorohydrin (EPI) as crosslinker for the selective recovery of Cd. Density Functional Theory (DFT) confirmed acrylamide as the best grafting agent with ΔG of -17.98 Kcal/mol for the acrylamide grafted chitosan. FTIR confirmed the grafting of acrylamide on chitosan as well as