Using bio-based $CaCO_3$ functionalized sediment to simultaneously remove algae and COD through adsorption and sedimentation in water source reservoirs

Highlights

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- Bio-$CaCO_3$-modified sediment traps algae and COD via EPS bridging.
- Nanostructured $CaCO_3$ forms core–shell clusters with active surface sites.
- Pores and charge heterogeneity promote selective pollutant retention.
- DFT reveals strong EPS–$CaCO_3$ interaction at molecular level.
- System optimization achieved by RSM and XDLVO energy modeling.