

## Cadmium Filter Cake of a Hydrometallurgical Zinc Smelter as a New Source for the Biological Synthesis of CdS Quantum Dots

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**Abstract :** The cadmium sulfide nanoparticles were synthesized from the nickel-cadmium cake of a hydrometallurgical zinc producing plant and sodium sulfide as  $\text{Cd}^{2+}$  and  $\text{S}^{2-}$  sources, respectively. Also, the synthesis process was performed by using the secretions of *Bacillus licheniformis* as bio-surfactant. Initially, in order to obtain a cadmium rich solution, two following steps were carried out: 1) Alkaline leaching for the removal of zinc oxide from the cake, and 2) acidic leaching to dissolve cadmium from the remained solid residue. Afterward, the obtained  $\text{CdSO}_4$  solution was used for the nanoparticle biosynthesis. Nanoparticles were characterized by the energy dispersive spectroscopy (EDS) and X-ray diffraction (XRD) to confirm the formation of CdS crystals with cubic structure. Also, transmission electron microscopy (TEM) was applied to determine the particle sizes which were in 2-10 nm range. Moreover, the presence of the protein containing bio-surfactants was approved by using infrared analysis (FTIR). In addition, the absorbance below 400 nm confirms quantum particles' size. Finally, it was shown that valuable CdS quantum dots could be obtained from the industrial waste products via environment-friendly biological approaches.

**Keywords :** biosynthesis, cadmium cake, cadmium sulfide, nanoparticle, zinc smelter

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