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Immobilization of heavy metals in polluted soils using nano-particles

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Heavy metals polluted soils are a significant worldwide environmental problem. The crops cultivated in polluted soils often contain significant levels of heavy metals (Cd, Pb., etc) that can impair human health. The current technologies such as; removing up of pollutants; stabilization/solidification of pollutants, vitrification, soil capping.., etc; used in remediation of polluted soils are not adequate. Smarter and cheaper techniques still to be addressed to decontaminate polluted soil. Nanotechnology offers a number of emerging techniques much more effective and less costly that could work to immobilize contaminants. Nanoparticles; nano scale zero valent iron "nZVI", nZVI-bentonite, Nano alginite, and nano carbon; are used as a potential sorbents to eliminate Cd and Pb from polluted soil. These nanoparticles are prepared in the lab either using bottom-up or top-down technique, then characterized using transmission electron microscope (TEM). The prepared nanoparticles proved to have very small size (less than 70 nm), high surface area (155-257 m2/g) and cation exchange capacity (30.3-60.7Cmolc/kg). Also, the prepared nanoparticles proved high adsorption capacity for Pb and Cd, and high retention for the adsorbed metal. The maximum adsorption capacity of nanoparticles ranged from 3954-25974 and 1598-93458 mg kg-1 for Pb and Cd, respectively. That is besides; only small quantities (9.3-20% and 0.4-23%) were released from the previously adsorbed Pb and Cd, respectively.

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Lithofacies superimposition in a shallow basin - interplay of tectonics and sedimentation: Evidences from Kolhan basin, Eastern India

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The 2.2-2.1 Ga pear shaped Kolhan basin show the development of a time transgressive group in a passive rift setting caused due to the fragmentation of the Rodinia supercontinent. The overall style of sedimentation reflect a switchover from low-sinuous avulsed channels developed within a braided-fluvial-ephemeral streams to a lacustrine fan- delta complex during the later part of the sedimentation history. The fan delta facies indicate sediment dispersal by hyper-concentrated flows in the form of sheet-floods and channelized flows. These different-scale cycles are interpreted as the sedimentary response to pulses of deformation of the basin margin at variable frequencies, related to the contemporary thrusts (ca. 20 km away from the basin). The episodes of tectonism downwarped the basin margin sediments and made the basin shift periodically toward the margin, and created progressive lithological changes in the sedimentary succession. The immediate effects of a tectonic pulse included lake transgression and accentuation of the structural hinge of the basin margin, causing a decline of sediment supply from the source rock. As the basin margin was subsequently reduced by denudation, the alluvial fans prograded and fan deltas were formed in normal conditions of graben subsidence. The sediment geometries and the climate exerted a major control on the processes of sediment transfer. The fluvial strata progressively onlap pre-rift rocks of the hanging wall block, whereas lacustrine strata pinch out against older fluvial strata at the centre of the basin but onlap pre-rift rocks along the lateral edges. This transition from fluvial to lacustrine deposition and hanging wall onlap relationships can be best explained by the fault growth models.

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