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Enhanced treatment of chloronitrobenzenes wastewater in coupled bio-electrode-anaerobic process via nano-magnetite addition

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Because of direct electron transfer process playing a key role in anaerobic reduction of persistent toxic organic compounds such as 2,4-dichloro-nitrobenzene (2,4-DClNB), a novel nano-magnetite enhanced bio-electrode-UASB reactor was established in this study, and the removal performance and reductive de-chlorination mechanism were investigated. Results showed that with the influent 2,4-DClNB load rates increasing from 25 g m^{-3} d^{-1} to 200 g m^{-3} d^{-1}, the COD, target pollutant removal and pH in combined system were stable relatively, and the removal efficiencies were up to 97% and 100%, respectively. The electrode biofilm was analyzed by SEM, and results showed that both the anode and cathode biofilms were covered with nano-magnetite. Inside the biofilms, there also existed nano-magnetite. This finding could further confirm that nano-magnetite plays an important role in enchanting extracellular electron transfer (EET) and pollutants removal in magnetite enhanced bio-electrode-UASB reactor.

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New nanomaterials for energy conversion and environmental processes requires high performance catalysts

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Future catalytic processes in the energy conversion and environmental fields will place ever-increasing demands on catalyst performance in terms of activity, selectivity, durability and cost. Several recent examples promise the required solution. Specially crafted nanorod-based catalysts for supporting nano metals such as gold and ruthenium have been used in reactions such as CO removal by oxidation or methanation respectively and have potential applications in exhaust emission and hydrogen production. These solids, in the case of gold display extremely and unusually high thermo stability. High activity modified nickel catalysts for methane decomposition for low carban energy conversion via hydrogen and carban fuel cells have been described. Microwave treatment and plasma treatments are both potentially useful as seen for iron-based catalysts used for the conversion of syngas (from fossil or renewable fuel sources) to liquid hydrocarbons. Finally, some high activity catalysts for the photo conversion of biomass-derived materials to hydrogen have been based on nano metals, nano titania-graphene composites which display heterojunction-based assistance in reducing the rate of electron-hole recombination, leading to high hydrogen production rates.

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