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Co-pyrolysis of synthetic oily waste containing heavy metals: Influence of operational conditions on the oil recovery and heavy metal immobilization

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This work proposes an alternative method for the safe disposal of metal-contaminated oily waste, generated during petroleum extraction. Co-pyrolysis of synthetic oily waste and hog fuel was conducted in a fixed bed reactor. Three experimental parameters (pyrolysis temperature, holding time, and hog fuel addition) were explored to optimize both oil recovery and metal immobilization. Using sequential extraction techniques, it was found that the distribution of metal ions in the various extraction fractions varied greatly with pyrolysis temperature. The higher the temperature, the more the metal ions existed in the non-bioavailable fraction. This is evident from the risk index (RI) for eco-toxicity assessment with a RI=34.63 at 600°C compared to a RI=117.14 at 400°C. In contrast, the maximum of oil recovery was achieved at a low co-pyrolysis temperature (400°C). The addition of hog fuel had a significant synergistic effect on the redistribution of metal ions infractions resulting in lower RI values but reduced the overall oil recovery. Considering the effectiveness of hog fuel addition in the heavy metal ions immobilization at a low pyrolysis temperature (RI=54.12 at 400°C), a low-temperature co-pyrolysis (400°C) using 20% of hog fuel with less energy consumption is deemed the most effective strategy for metal-containing oily waste disposal.

Biography

Yuan Tian is a PhD candidate in environmental studies at the University of Northern British Columbia. Her research interests focus the remediation of oily sludge with added economic and environmental benefits. She is currently working on ionic liquid enhanced solvent extraction for oily recovery from oily sludge. She holds an MSc in safety engineering from Beijing Institute of Technology and a BEng in safety engineering from Anhui University of Science and Technology. For her master's thesis, she simulated the propagation of the gas-solid and gas-liquid explosion using the self-developed program. The results have been published in the Journal of Safety and Environment.

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