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Development of amino-functionalized silica nanoparticles for efficient and rapid removal of COD from pre-treated palm oil effluent



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ABSTRACT

In this study, low cost synthesis of three-dimensional mesoporous amino-functionalized silica nanoparticles (AFS-NPs) were synthesized by sol-gel method with the addition of two different silica modifiers, 3-aminopropyltrimethoxysilane (APTMS) and 3-aminopropyltriethoxysilane (APTES) to two different silica sources, tetramethoxyorthosilicate (TMOS) and tetraethoxyorthosilicate (TEOS) separately. The presence of amino group on synthesized nanoparticles from the four different combinations was confirmed by Fourier transform infrared (FTIR) spectroscopy. The synthesized AFS-NPs were of narrow particle size within the range of 500–600 nm and having high specific surface area ($148 \text{ m}^2 \text{ g}^{-1}$). The AFS-NPs were then utilized to investigate the adsorptive removal of COD from palm oil mil effluent (POME). The maximum removal efficiency (>90%) of AFS-NPs was found at pH 7, adsorbent dose 0.25 g and temperature 30°C . At equilibrium the maximum adsorption capacity was found to be 271.11 mg g^{-1} . The Langmuir adsorption isotherm gave the best fit to the experimental data signifying the presence of adsorption monolayer on the surface of the adsorbent. The results have positively qualified grafted silica nanoparticles as one of the adsorptive media for removal of COD from POME.

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