

Catalytic Properties of M-HMS Materials

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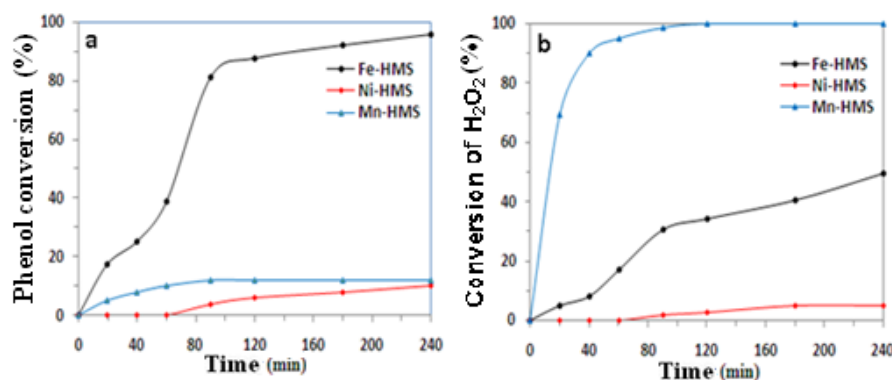
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Metal-incorporated hexagonal mesoporous silica, M-HMS (M = Fe, Ni, Mn), were synthesized at ambient temperature using hexadecylamine as template at room temperature. Chemical analysis, nitrogen adsorption, XRD, FTIR, UV-Vis spectroscopy and SEM microscopy were employed to analysis these materials. The catalytic activity of these materials was tested in the catalytic wet peroxide oxidation of aqueous phenol under mild reaction conditions.

The catalytic results indicated that Fe-HMS is more stable in aqueous solution and more active (about 96% phenol conversion) than Ni-HMS (10%) and Mn-HMS (12%). The decomposition of H₂O₂ in the presence of Mn-HMS is very fast and reaches almost 100% after one hour of reaction whereas in the presence of Ni-HMS, its decomposition is very slow and very weak (5% at t = 4h). These results show that the decomposition of H₂O₂ involves the formation of hydroxyl radicals in the presence of Fe-HMS whereas in the presence of Mn-HMS, H₂O₂ decomposes probably into molecular oxygen.



A recycling test indicates that the initial catalytic activity of Fe-HMS recovered by drying in air at 423K and reused without calcination decreased by 12.4%. The textural properties of recycled Fe-HMS show that the oxidation of phenol affects the sorption properties of the material and modifies the morphology of these pores. After the first cycle, there is a decrease of about 32% of the total pore volume and 29% of its specific surface area. The method of regeneration needs to be optimized further to improve catalytic efficiency.