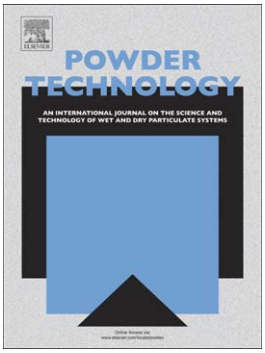

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PII: S0032-5910(17)30080-3
DOI: doi:10.1016/j.powtec.2017.01.060
Reference: PTEC 12302

To appear in: *Powder Technology*

Received date: 24 October 2016
Revised date: 29 December 2016
Accepted date: 25 January 2017

Please cite this article as: Hua-Wei Chen, Chyow-San Chiou, Shu-Han Chang, Comparison of methylparaben, ethylparaben and propylparaben adsorption onto magnetic nanoparticles with phenyl group, *Powder Technology* (2017), doi:10.1016/j.powtec.2017.01.060

Comparison of methylparaben, ethylparaben and propylparaben adsorption onto magnetic nanoparticles with phenyl group

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ABSTRACT

Parabens (such as methylparaben (MP), ethylparaben (EP) and propylparaben (PP)) are widely used as preservatives in food, medicine and cosmetic products but can destroy the cell membrane of microbes, intracellular protein and the enzyme activity of microbial cells. In this study, the surface of magnetite was modified with styrene (St) as the functional monomer, divinylbenzene (DVB) as the cross-linking agent, polyvinyl pyrrolidone (PVP) as the stabilizer, 2,2-azodiisobutyronitrile (AIBN) as the radical initiator and ethanol as the solvent to prepare magnetic nanoparticles with a phenyl group (PS/Fe_3O_4) and use this phenyl compound to absorb parabens. The adsorption behaviors of MP, EP and PP on PS/Fe_3O_4 were almost totally pH-independent because the phenyl ring of PS/Fe_3O_4 adsorbs MP, EP and PP by π–π electron-donor–acceptor interactions. The Langmuir isotherm indicated that the maximum adsorption capacity of PS/Fe_3O_4 followed the order of PP (3.5421 mg g^{-1}) > EP (3.2862 mg g^{-1}) > MP (0.6015 mg g^{-1}) possibly owing to the hydrophilic and hydrophobic properties. The mechanism of adsorption confirmed that the adsorption process of MP, EP and PP followed the second-order kinetic model, which suggested that the adsorption process was quite rapid