



## XVII<sup>th</sup> World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR)

Hosted by the Canadian Society for Bioengineering (CSBE/SCGAB)  
Québec City, Canada June 13-17, 2010



### ADSORPTIVE REMOVAL OF PHOSPHATE ANIONS FROM AQUEOUS SOLUTIONS USING FUNCTIONALIZED SBA-15: EFFECTS OF THE ORGANIC FUNCTIONAL GROUP

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#### CSBE101305 – Symposium on Nanotechnologies Applied to Biosystems Engineering and the Environment symposium

**ABSTRACT** Water pollution stemming from agricultural activities is a multidimensional serious environmental worldwide problem encompassing several types of pollutants such as phosphates, nitrates and pesticides. Phosphates are particularly deleterious as they are implicated in aquatic eutrophication. The present work is devoted to the study of the adsorption process for phosphate ( $\text{H}_2\text{PO}_4^-$ ) from aqueous solutions over mesoporous silica SBA-15 materials modified with mono and di-ammonium organic functional groups. The objectives pursued are: i) synthesis and characterization of the adsorbents; ii) experimental investigation of the effects of the number of amino groups in the organic chain in functionalized silica material as well as the loading of amino-functional groups in the silica framework on the adsorption performances. The adsorbents were prepared via a post-synthesis grafting method. They were then characterized using nitrogen adsorption, powder X-ray diffraction, CHN-elemental analysis and solid state  $^{13}\text{C}$  and  $^{29}\text{Si}$  NMR. The adsorption tests were performed batchwise at room temperature. The loading of amino moieties on the SBA-15 surface was varied from 5 to 40 % as organoalkoxysilane/silica (OF/Si) molar ratio. Results showed that adsorption capacity increased with increasing the concentration of functional groups on the SBA-15 adsorbent. In the case of monoammonium functional groups, the adsorption capacity increased from 0.64 to 1.07 mmol  $\text{H}_2\text{PO}_4^-/\text{g}$  when the OF/Si ratio was varied from 5 to 40 %, respectively. Similar tendency was observed in the case of diammonium organic functional group. Also, for the same OF/Si molar ratio, the adsorption capacity increased markedly with the increase of the number of protonated amines in the functional groups. Therefore, maximum adsorption capacities of 1.07 and 1.70 mmol  $\text{H}_2\text{PO}_4^-/\text{g}$  adsorbent were obtained using mono- and di-functionalized SBA-15, respectively.

**Keywords:** Adsorption, Phosphate, Mesoporous silica, Ammonium-Functionalized SBA-15