

SYNERGISTIC EFFECTS BETWEEN NITROGEN FUNCTIONALITIES AND METALS CONTENT ON THE REMOVAL OF PHOSPHATE IONS

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The release of phosphate ions in the runoff is today a major threat to the environment and humans. Therefore, it is vital to develop effective technologies to remove phosphate ions from aqueous solutions before they are discharged into runoff and natural water bodies. This study aims to evaluate and proposed a mechanism of phosphate adsorption by using nitrogen and metals-functionalized chars. In order to isolate the contribution of individual components of lignocellulosic biomass, simple cellulose was used for the char production.

Five samples of nitrogen-doped chars were produced via annealing cellulose under ammonia gas at different temperatures (500, 600, 700, 800, 850 and 900 °C). Some of the analytical techniques used for the chars characterization were: Elemental and proximate analysis, gas physisorption analysis, Scanning Electron Microscopy and X-ray photoelectron spectroscopy analysis. These samples were subsequently used for phosphate adsorption. Characterization of the resulting chars shows an increase of the nitrogen content in the samples, where the greater percentage of it appears at a temperature of 800 °C (12.5 wt%) and the maximum surface area was for char produced at 900 °C (1314 m²/g).

To evaluate the effect of nitrogen and metals in char to adsorb phosphate ions, three sets of chars were produced at 800 °C; char with magnesium and nitrogen (Mg_N_char); char with nitrogen (N_char) and char with magnesium (Mg_char). The results show that Mg_N_char sample exhibits a maximum adsorption capacity of 340 mg/g, whereas the Mg_char and N_char samples give an adsorption capacity of 7.8 mg/g and 21.4 mg/g respectively. These results demonstrate that the presence of magnesium and nitrogen in chars is very effective in the retention of phosphate ions. Other metals such as Fe and Ca combined with nitrogen will also be tested, details of the results will be presented at the conference.