DESIGNING ACTIVATED MINERAL BIOCHAR COMPOSITES FOR THE ADSORPTION AND DEGRADATION OF EMERGING CONTAMINANTS

Christian Wurzer, UK Biochar Research Centre, School of GeoSciences, University of Edinburgh, UK
c.wurzer@ed.ac.uk
Pierre Oesterle, Faculty of Science and Technology, Department of Chemistry, Umeå University, SE
Stina Jansson, Faculty of Science and Technology, Department of Chemistry, Umeå University, SE
Ondřej Mašek, UK Biochar Research Centre, School of GeoSciences, University of Edinburgh, UK

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The emergence of micropollutants such as pharmaceuticals in wastewaters presents a potential risk for human health as well as the aquatic environment. Current wastewater treatment plants are generally not capable of removing these pollutants without additional treatment steps. Adsorption on activated carbon is an effective way to remove these contaminants, however, the use of non-renewable feedstocks as well as low regeneration efficiencies increase the environmental costs of this method[1]. Biochar as an alternative carbon platform material can be specifically designed to overcome these drawbacks[2]. This study is aimed at designing activated mineral biochar composites with enhanced adsorption capacity for pharmaceuticals while simultaneously increasing its regeneration performance. Two standard biochars from the UK Biochar Research Centre produced at 550°C from softwood and wheat straw were activated in CO_2 at 800°C. Mineral biochar composites were produced by the addition of ochre – a Fe-rich mining waste - in a wet mixing step prior to pyrolysis for both feedstocks. The activated biochars were analysed for their maximum adsorption capacity for two common micropollutants. Furthermore, to test their regeneration performance, the biochars were loaded with a mix of 10 pharmaceuticals covering antibiotics, fungicides and antidepressants. The loaded biochars were then subjected to a high pressure treatment in a hydrothermal reactor at temperatures ranging from 160 to 320°C to determine the degradation rate of pharmaceuticals loaded on the different materials. Hydrothermal treatment was found to successfully degrade the micropollutants across all biochars. The mineral biochar composites showed increased pollutant degradation, lowering the necessary treatment temperature to achieve full decontamination. The results show that while designing biochar for certain applications, a simultaneous focus on both the application as well as the regeneration of the material can give a more comprehensive picture of the overall requirements for further optimisation of biochar adsorbents.

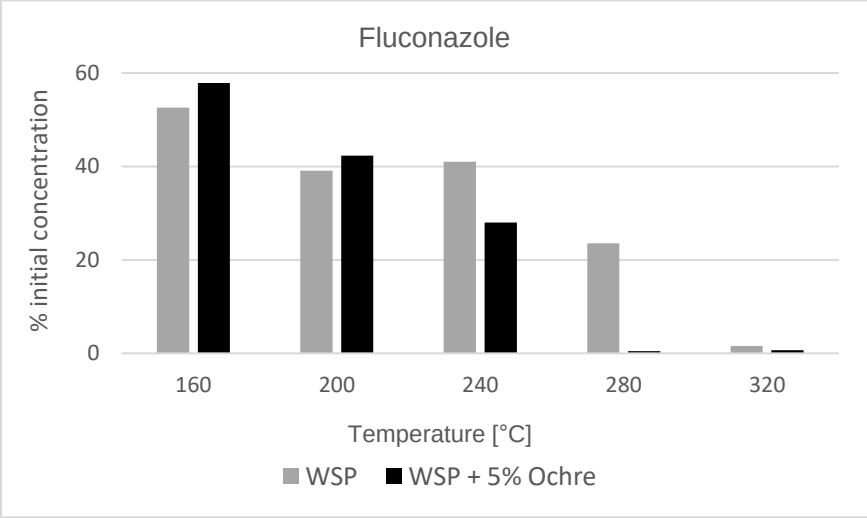

Figure 1: Residual Fluconazole concentration after hydrothermal treatment at 160-320 °C (WSP – Wheat straw pellet biochar

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