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Utilization and Conversion of Sewage Sludge as Metal Sorbent

Xu Dong Gong and Loretta Y. Li

Department of Civil Engineering, University of British Columbia, 6250 Applied Science Lane, Vancouver, B.C. Canada V6T 1Z4 (lli@civil.ubc.ca)

Most biosolids are disposed on land. With improvements in wastewater treatment processes and upgrading of treatment plants across Canada, biosolids generation will increase dramatically. These biosolids will need to be dealt with because they contain various contaminants, including heavy metals and several classes of emerging contaminants. A number of researchers have recently focused on preparation of sewage sludge-based adsorbents by carbonation, physical activation and chemical activation for decontamination of air and wastewater. These previous studies have indicated that sludge-based activated carbon can have good adsorption performance for organic substances in dye wastewater. The overall results suggest that activated carbon from sewage sludge can produce a useful adsorbent, while also reducing the amount of sewage sludge to be disposed. However, sludge-derived activated carbon has not been extensively studied, especially for adsorption of heavy metal ions in wastewater and for its capacity to remove emerging contaminants, such as poly-fluorinated compounds (PFCs). Previous research has indicated that commercial activated carbons adsorb organic compounds more efficiently than heavy metal ions. [45] Activated carbon can be modified to enhance its adsorption capacity for special heavy metal ions,[46] e.g. by addition of inorganic and organic reagents. The modifications which are successful for commercial activated carbon should also be effective for sludge-derived activated carbon, but this needs to be confirmed. Our research focuses on (a) investigation of techniques for converting sewage sludge (SS) to activated carbon (AC) as sorbents; (b) exploration of possible modification of the activated carbon (MAC) to improve its sorption capacity; (c) examination of the chemical stability of the activated carbon and the leachability of contaminants from activated carbon,; (d) comparison of adsorptivity with that of other sorbents. Based on XRD and FT-IR, we successfully converted SS to AC and further modified it to improve absorption. SSMAC has large specific surface areas based on the BET technique. Batch adsorption results indicate that metal adsorption for SSMAC > SSAC, with adsorption occurring within the first 5 minutes of contact. Comparison of the adsorptivity of various sorbents such as commercial activated carbon (CAC), mineral sorbents such as perlite, clinoptilolite and illite indicates that SSMAC $\geq$ CAC $\geq$ clinoptilolite > kaolite.