Carbon 2019 Abstract Submission

Carbon Monoxide Capture by Activated Coconut Shell Carbon: Temperature-Programmed Chemisorption and Physisorption Experiments

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Abstract

In this project we investigate the efficiency of sorption of carbon monoxide (CO) by activated carbon (AC) produced from coconut shell waste. Carbon monoxide, which is formed by incomplete combustion of carbon-based fuels, is a leading cause of accidental poisoning in both domestic and industrial environments. Activated carbon can efficiently trap CO molecules due to a very large surface area (up to 1,000 m^2/g) and well-developed microporous structure (pores < 2 nm). However, the mechanism of CO interaction with AC-based filters is still unclear. Will CO form weak intermolecular bonds (reversible adsorption) or stronger high energy chemical bonds (irreversible adsorption)? Quantifying the type and number of CO-AC bonds will help to estimate sorption capacity and efficiency of AC-based filters towards CO.

Specifically, in this work we investigate the effects of surface pretreatments and modifications of pore structure of coconut shell carbon. Acid digestion followed by pyrolysis of coconut shell powder yields carbon (biochar) mass of 15 to 23% of the original coconut shell powder. The Brunauer-Emmett-Teller (BET) surface area analyses showed an increasing trend of coconut shell powder (0.94 m^2/g) < biochar (919 – 967 m^2/g) < activated carbon (1,400 m^2/g). Also increasing with activation were the micropore area (from 700 to 800 m^2/g) and t-Plot external surface area (from 233 to 874 m^2/g) for the activated and non-activated samples, respectively. Carbon monoxide pulse chemisorption was used to find the amount of CO adsorbed and temperature-programmed desorption (TPD) to find the strength of CO bonding.