USING THE JIGGLED BED REACTOR TO DEVELOP ACTIVATED CARBONS FROM BIOMASS RESIDUES

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Activated carbons are the most used adsorbent material. Their applications range from wastewater treatment, air purification, removal of contaminants and many others. According to "Global Activated Carbon Market Forecast & Opportunities 2017", the demand for activated carbon is expected to increase more than 10% per year for the next 5 years to make it a $3 billion market by 2017. Current processes for the production of activated carbons from renewable resources do not provide valuable co-products. This presentation focuses on the conversion to activated carbon of the bio-char co-product of the pyrolysis process. Pyrolysis also provides valuable bio-oil, which is a source of valuable biochemicals and fuels. This can greatly improve the economics of the pyrolysis process and the development of bio-refineries.

In this study, a number of different agricultural and forestry residues were investigated as precursors for the production of activated carbons. The activated carbons were then tested for the removal of typical pollutants. A lab scale reactor, the jiggled bed reactor, was used for this study. Its unique features such as excellent mixing and heat transfer allowed for the screening of the impact of pyrolysis conditions (ranging from fast to slow pyrolysis) and activation on the final product properties.

Optimal activation and pyrolysis conditions, as well as the most attractive feedstocks, were identified. Two feedstocks were identified as the most attractive: Kraft lignin, a by-product of pulp and paper mills, and olive residue, which is a major environmental concern in the Mediterranean area and, in particular, Crete. Activated carbons from these two feedstocks were tested for removal of contaminants such as naphthenic acids from oil sands process affected water, and ammonia and mercury from wastewater. They performed as well or better than commercial activated carbons, as shown for example in Figure 1 in the case of oil sands process affected water.
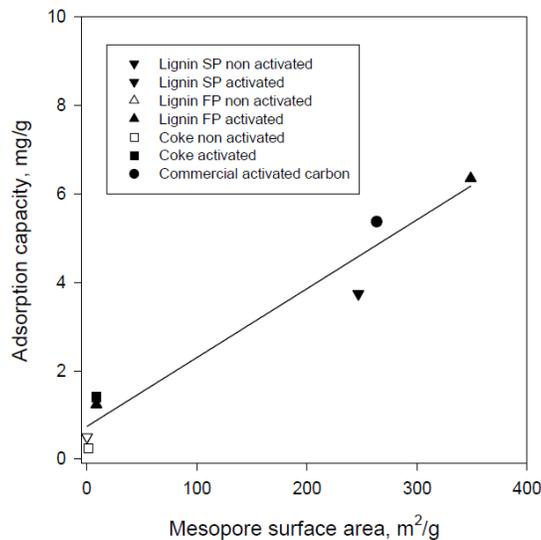

Figure 1- Comparison of the performance of different carbons for the removal of naphthenic acids from oil sands process affected water