54e Potential of Animal Manure-Based Activated Carbons for Use in Heavy Metals Remediation

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The United States has a strong agricultural foundation that leaves behind large quantities of both plant and animal wastes. Animal waste continues to represent a significantly large and problematic portion of the U.S. agricultural waste generated yearly. Georgia, Alabama and Mississippi together contribute about to 1/3 of the nations supply of broilers generating in excess of 3 million tons of manure. Nutrient buildup due to excessive manure application onto soils, can lead to non-point source pollution runoff into rivers and streams. One of the best ways to manage this disposal problem and to use animal waste to its full potential is to transform it, from an environmental hazard to an environmental solution.

Our research group with the Commodity Utilization Research Unit at ARS' Southern Regional Research Center in New Orleans, Louisiana, is looking into converting various animal manures with focus on poultry manure into a material that can be used to help keep the environment clean. Our research project, unique to ARS and to our best knowledge, with unprecedented art, involves manufacturing activated carbons from animal waste, with a strong focus on poultry manure. Development of these value-added products can give animal waste producers profitable solutions for their disposal problem and make value out of the waste by producing superior, less costly adsorbents that will compete successfully with currently available activated carbon products. Four different types of animal manures (broiler, turkey, swine and dairy) have been converted into granular activated carbons, via pyrolyzation and activation of a pelletized sample of manure. The resulting carbons were characterized in terms of their physical properties (yield, surface area, attrition, bulk density) and adsorptive properties for four metal ions (Cu2+, Cd2+ Ni2+ and Zn2+) from single metal solutions as well as in competition. Carbons made from coal, coconut shell and wood and produced under the same conditions were used as reference. Yield and surface area of the manure-based carbons were lower and attrition higher than the reference carbons, yet the carbons produced from animal manure adsorbed up to 6 times the amount of Cu2+, Cd2+ and Zn2+ adsorbed by the reference carbons.

The low cost and high availability of large quantities of animal manures generated at concentrated animal facilities throughout the United States make them an attractive feedstock for carbon production. This novel approach to the utilization of animal manure can create new markets for animal manures, a new inexpensive source for activated carbons, and a cleaner environment.