

DEVELOPING A NOVEL METHOD OF DETERMINING SURFACE AREA OF GROUND BIOMASS PARTICLES

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Abstract:

Surface area of ground biomass particles significantly influences rate of biochemical reaction, heat and mass transfer, bioconversion processes, and energy involved in feedstock size reduction. However, the measurement of surface area of ground biomass particles is difficult due to the complexity and irregularity in shape, size uneven distribution, and organic nature of the materials. Therefore there is a paucity of reported literature in this field of research. The present study explored a novel approach of utilizing chemical coating adsorption to estimate the surface area of ground biomass particles. In principle, this approach is similar to chemical adsorption methods used with soil particles surface area determination. The chemical used is ethylene glycol monoethyl ether (EGME), which forms a monolayer on the surface of the particles and allows for surface area estimation. Switchgrass stems splits were utilized as the test material and proof-of-concept was demonstrated applying geometrical approach. The theoretical surface area of samples was evaluated geometrically considering switchgrass stems splits as cylindrical troughs. A linear relationship of geometrical surface area of the switchgrass stem splits with the mass of chemical adsorption was observed, which proved the effectiveness of the method. It was also observed that the chemical adsorption on the switchgrass sample was different from that of soil particles since the former is permeable while the later is impermeable to the adsorption coating chemical. This variation was addressed by evaluating calibration constants from the regression of the mass of chemical adsorption (may include infiltrated chemical) with the switchgrass geometrical estimated surface area. The novel approach is simple and easy to apply. It can be applied to other ground biomass materials after determining relevant chemical coating calibration constants.

Keywords: Adsorption, Biomass, Ethylene glycol monoethyl ether, Particle, Surface area