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Gasification of biomass in supercritical water to produce fuel gas
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The goal of this project is to determine the feasibility of a process for the thermochemical conversion of rice straw into fuel gas using supercritical water as a reaction medium. This will simultaneously eliminate a disposal problem and create renewable energy. Rice straw is an abundant, cheap biomass, and using water as a solvent and reactant eliminates expensive drying procedures required to remove water from the biomass. We gasified .20 grams of rice straw in 1.00 gram of water at a temperature of 700°C in a 10 mL batch reactor. Thus far, we have used varied heating times (5, 10, 15 minutes) and compared char formation versus heating time. After performing several trials varying heating times, we used a thermocouple to monitor the time required to heat the reactor to supercritical conditions. Our findings showed that the reactor took about 20 minutes to reach 700°C, and that char formation was greatest for the trials only heated for 5 minutes. In all trials, the reactor was surrounded by sand in an oven. Speculating that sand may be undesirably insulating the reactor from heating, we are currently performing a series of experiments to test char formation of a reactor placed on top of the sand. Future experiments to be performed in the batch reactor include use of a catalyst, heating to different temperatures, varying the biomass, and varying ratio of biomass to solvent. We also will be performing experiments with gasification of rice straw in a continuous reactor.