

Ex-situ carbonation of mixtures of caustic byproduct materials and produced oil-field brine provides a niche opportunity to sequester anthropogenic CO_2 , while concomitantly reducing the basicity of the reactive slurry. A series of tests were conducted to investigate a novel reaction concept designed to achieve neutralization of mixtures of acidic oil field produced brine and caustic industrial byproducts while sequestering substantial quantities of anthropogenic carbon dioxide (CO_2) in a mixed-flow reactor. Experiments were conducted to determine the CO_2 -bearing capacity of reactive mixtures of brine from the Oriskany Sandstone Formation with three caustic industrial byproducts: flue gas desulfurization (FGD) spray dryer ash, Class C fly ash subbituminous coal combustion byproduct, and bauxite residue slurry from the alumina production process. Reactions were conducted in a closed, well-mixed (1,500 rpm) reactor with gas composed of 29.46% vol./vol. CO_2 balanced by nitrogen gas (N_2) fed at a rate of 300 mL/min. Reactions were carried out at ambient conditions. Results show linear relationships between caustic byproduct addition and CO_2 -bearing capacity, with relatively small impact of brine addition as compared to deionized water addition. FGD spray dryer ash/brine mixtures exhibited higher CO_2 reactivity than those using Class C fly ash (0.759 moles CO_2 at 23.6% solids by weight and 0.036 moles CO_2 at 23.3% solids by weight, respectively). Bauxite residue exhibited moderate capacities in mixtures with higher percent solids (0.335 moles CO_2 in 40% solids bauxite residue slurry). Carbonation capacity of caustic byproduct/acidic brine mixtures was shown to increase linearly with respect to percent caustic byproduct addition, but enhanced mineral carbonate precipitation resulting from synergistic reaction of brine cations with increased dissolved carbonate species was not observed in the short term.