The use of transition metals, organotin hydrides (R_3SnH) and silyl hydrides (R_3SiH) to catalyze reductions has further promoted certain dehalogenations.

Destruction of toxic organic materials and sludges by supercritical water oxidation

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Abstract

The objectives of this continuing research project were to: (1) design and develop a more efficient batch-microreactor system; (2) obtain supercritical water oxidation (SCWO) data from batch reactors and continuous-flow reactor systems; and (3) evaluate SCWO performance for toxic wastewaters and waste treatment plant sludges.

A second unique batch-microreactor system (UT Mark II) was designed and constructed. The special feature of this system was its capability to simulate temperature-depth profiles of deep-well, subcritical and supercritical water oxidation reactor systems. The main components of the new batch-microreactor included a tubular reactor vessel (0.65 cm I.D. × 0.95 cm O.D. × 122 cm length), an electrical heating system consisting of two electrodes located near the ends of the tubular reactor vessel, a mechanical agitation device, temperature and pressure recorders, and a microcomputer controller. Electric current was passed through the wall of the tubular reactor vessel to generate the heat required to raise the reaction temperature. The heat-up rate was programmed by the microcomputer. The UT Mark II system was capable of simulating a deep-well SCWO reactor.

To evaluate the performance of the two batch reactor systems (UT Mark I-developed during the first year, and UT Mark II), an anaerobically digested municipal sludge and an industrial excess activated sludge were tested under subcritical and supercritical water oxidation conditions. The batch tests with the UT Mark I indicated the organic substances in the sludges could be destroyed to any desired level subject to supercritical temperatures and residence times. For example, at 450°C, more than 99% of the COD was removed from both anaerobically digested municipal sludge and industrial, excess activated

sludge. The residence times for the municipal sludge and industrial excess activated sludge were 4 min and 12 min, respectively. The volume reductions for both sludges were greater than 90%. In subcritical water conditions, a residence time of one hour was required to achieve 90% COD removal for the sludges.

In previous tests with the UT Mark I, the destruction efficiencies under SCWO conditions were greater than 99.99% for chlorinated phenols, 2,4-nitrotoluene, and ethylene glycol.

Industrial excess activated sludge was tested with the UT Mark II. The temperature was increased at a given rate to a desired maximum temperature, and after a predetermined residence time, decreased to an ambient temperature. A COD reduction of 93% was achieved with a residence time of 12 min and a maximum temperature of 400°C.

Similar COD removal efficiencies for both of the sludges were obtained with a continuous flow reactor system. At a temperature of 450°C or above, the COD removal was greater than 95%.

Test results demonstrated that toxic substances and waste treatment plant sludges were efficiently destroyed. The batch, microreactor data were in good agreement with the continuous flow data. Therefore, the batch-microreactor systems can be used to provide kinetic data and assist in the design of continuous flow reactor systems.

Detoxification of polyhaloaromatics via fluoroalkoxylation technology

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Abstract

The goal of this study is to define the chemical reaction parameters necessary to remove one or more halo groups from polyhaloaromatics using the well-