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WMRC

Improvements in
Process Efficiency

Wet Air Oxidation

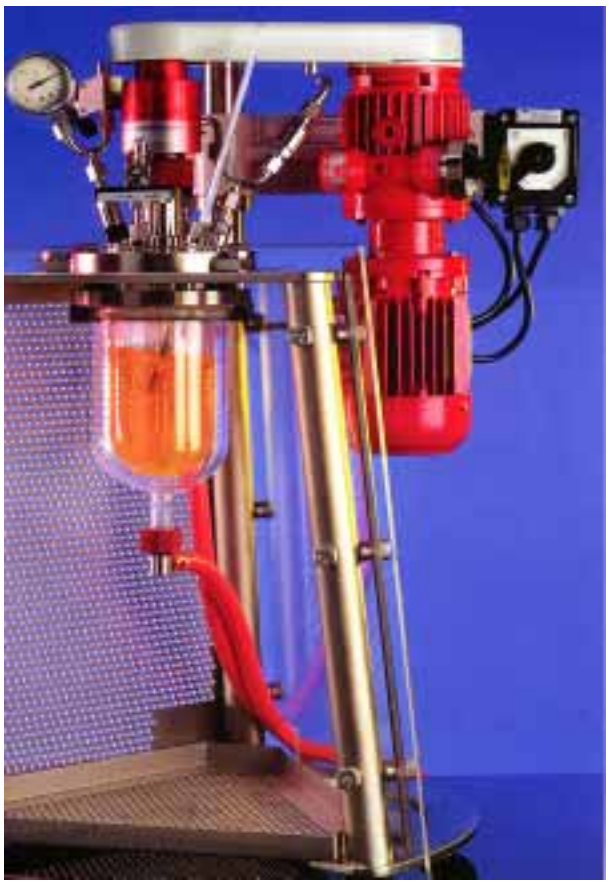
Aqueous waste streams are generated from some manufacturing processes and from waste treatment processes such as absorption, adsorption and membrane filtration. These waste streams are often too dilute for incineration and too refractory or toxic to be treated by other chemical and biological processes. Wet Air Oxidation (WAO, oxidation in aqueous phase), has proven to be an effective technology for ultimate destruction of a variety of these hazardous wastes. In 1984, the USEPA specified WAO as a "Best Demonstrated Available Technology (BDAT)" for many land-banned wastes under the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA). As environmental regulations on discharge of harmful substances become restricted further, the use of WAO stands out as an efficient and cost-effective alternative for treating toxic and hazardous wastes.

WAO has been tested on process waste streams from petrochemical, pharmaceutical, pesticide, and metal processing industries. Concentrated waste streams such as industrial sludge, spent carbon from adsorption processes, or residuals from membrane separation processes can be treated successfully with WAO.

Technology:

WAO is a chemical oxidation process that occurs in an aqueous matrix at elevated temperatures and pressures in the presence of oxygen. Higher temperatures and pressures accelerate the oxygen transport and reaction rates causing efficient destruction of the hazardous components of the waste. WAO systems typically operate at temperatures of 150°C to 320°C and at pressures ranging from 150 to 3000 psig. Specific parameters such as (a) oxidation temperature, (b) oxidation pressure, (c) residence time, (d) oxidant dose, and (e) type and amount of catalyst (if required) must be evaluated for a given waste stream to ensure successful application.

During the WAO process, the waste stream is placed in a reactor and brought up to system pressure using a high pressure pump and followed by the addition of compressed air. The mixture is heated by means of a process heat exchanger. The operating conditions



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Wet Air Oxidation (continued)

are maintained for sufficient time to achieve desired destruction of the hazardous components. The products of the oxidation may be either carbon dioxide and water or partially degraded remnants of the original hazardous component that are readily biodegradable. The cooled reaction products tend to be non-hazardous and amenable to biological treatment, where necessary.

WAO process costs vary depending on the waste stream and operating conditions. The cost, in general, falls between biological oxidation and incineration. Successful application of the WAO process depends on carefully conducted bench scale evaluations and pilot studies.

Applications:

WAO can treat wastewaters containing both oxidizable organics and inorganics. WAO processes achieve Chemical Oxygen Demand (COD), Total Organic Carbon (TOC) and Total Volatile Solids (TVS) reduction. Its applications are most beneficial to treat waste streams with dissolved or suspended organic content between 500 and 15,000 mg/L. WAO has been tested for metal containing waste streams, pesticides, cyanide containing wastes, spent caustic wastewaters containing phenolic compounds, substituted toluenes, nitro and amino compounds, and various heterocyclic compounds. WAO is also applicable to complex wastestreams such as industrial sludges and spent carbon from adsorption processes. Recently, WAO has been successfully tested for treating a variety of hazardous
explosive wastes.

WMRC Capabilities:

The Illinois Waste Management & Research Center (IWMRC), a division of the the Illinois Department of Natural Resources and is based on the campus of the University of Illinois, Urbana-Champaign. The Center houses 20,000 sq.ft. of pilot and analytical facilities especially designed to carry out research into innovative technologies designed to prevent pollution and treat hazardous waste. The Centers' resources include several process laboratories and a pilot lab designed to carry out studies on highly hazardous materials, a toxicology laboratory and a variety of analytical instrumentation.

The Center has several reactors designed to carry out WAO studies backed by highly qualified personnel to assist in experimental design, analytical workup, and data analysis and interpretation.

Industries interested in performing WAO treatability studies are encouraged to contact WMRC. For more information please contact Dr. Kishore Rajagopalan (217-244-8905) or Mr. Tim Lindsey (217-333-8955). You can also refer to our web page at: www.wmrc.uiuc.edu