Inez Hua

Associate Professor,
Environmental Engineering
School of Civil Engineering

Education
BA, *Biochemistry*, 1990, UC Berkeley
MS, *Environmental Engineering Science*,1992, Caltech
PhD, *Environmental Engineering Science*, 1995, Caltech

Appointments and Affiliations
U.S. EPA, Region 9 Headquarters
+Sabbatical leave (2002)

Center for the Environment,
Discovery Park

NASA Ames (Mountain View, CA)
+NASA/ASEE Summer Faculty Fellow
(2003, 2004)

+Internal Executive Committee

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Current Research Areas

General topics:
Sustainability, industrial ecology, water pollution control, environmental chemistry

Acoustic cavitation as an advanced method for water pollution control…
Ultrasonic irradiation (as a technology) effectively and rapidly destroys a variety of pollutants, including aromatic and halogenated organic compounds, pesticides, oxygenated fuel additives (MTBE), and inorganic compounds (H_2S). The technology has also been applied to disinfection (inactivation of microbes) and enhancement of membrane processes.

The utility of ultrasonic processes is not limited to 'end - of - pipeline' treatment applications.

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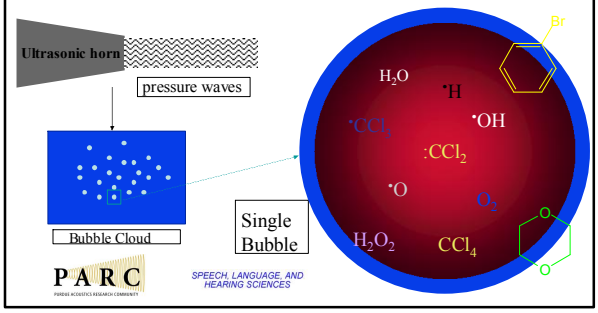
Acoustic Cavitation

The formation and implosive collapse of microscopic bubbles resulting from the passage of ultrasonic waves through liquid. Localized high temperatures (~3300 K) and pressures (~300 atm) develop within the bubble.



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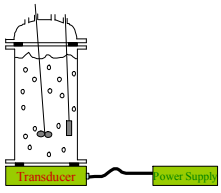
Methodologies

Process Parameter	Batch Reactor Performance Attributes
Sparge gas	Kinetics (rate of chemical destruction)
pH	Effectiveness (extent of chemical destruction)
Ultrasonic power	By-product formation (mechanism)
Chemical agents	Formation of free-radicals
Ionic strength	Energy efficiency
Natural organic matter (NOM)	



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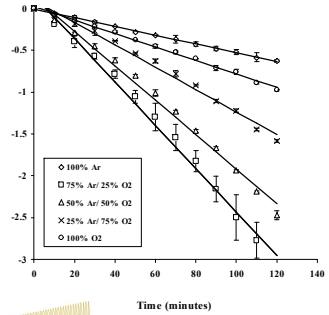
Recent Results



Destruction of 1,4-dioxane by ultrasonic irradiation

•1,4-dioxane is an emerging pollutant

•Solvent stabilizer; often a co-contaminant with chlorinated solvents

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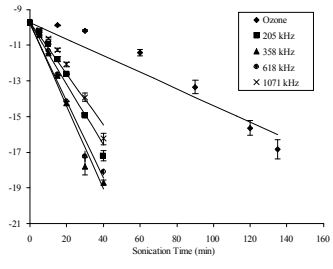
Recent Results

Alachlor (pesticide) destruction during ultrasonic irradiation and ozonation.



Ultrasound enhances the performance of other water treatment technologies

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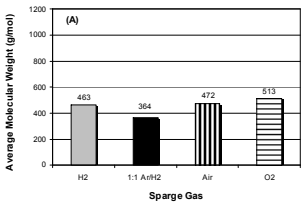
Recent Results

Upgrading asphaltenes via ultrasonic irradiation

•Asphaltenes are an issue during petroleum refining.

•Molecular weight reduction enhances solubility

•Effects of sparge gases in the 205-kHz reactor on molecular weight reduction of asphaltene after 30 min of sonication.



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Future Directions

•Passage of the Pollution Prevention Act -- shift in paradigm
Preference for and economic benefits of manufacturing and production process modifications that reduce pollution at the source, rather than reliance on "end-of-pipeline" treatment technologies.

•The development and optimization of "green technologies" would capitalize on the expertise of many faculty and encourage new collaborations.

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Future Directions

•Ultrasonic irradiation can be applied as a "green technology".
Examples: sonication renews solid catalyst surfaces during synthesis processes, and provide an aqueous based reaction medium for reactions. Larger scale, high- throughput applications of ultrasound include aqueous based cleaning systems that eliminate or reduce the need for large volumes of organic solvents.

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