USE OF ACOUSTIC TECHNIQUES COUPLED WITH ADVANCED OXIDANTS FOR DEODORIZING AGRICULTURAL WASTES

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Abstract

Acoustic cavitation involves sound waves transmitted through a liquid as a wave of alternating cavitation cycles. Compression cycles exert a positive pressure on the liquid, pushing molecules together, while expansion cycles exert a negative pressure, pulling molecules away from each other. During rarefaction, microbubbles are formed that grow to a critical size during the alternating cavitation cycles and implode, releasing a large amount of energy. Temperatures near 5,000ºK and pressures of 500 to 1,000 atmospheres have been observed in microbubble implosions, while the bulk solution stays near ambient. The collapsing bubble interface forms hydroxyl and hydrogen radicals.

In a modification of this process, an underwater plasma is formed by setting off an electrical discharge by pulsing a sparking device. In our current system, a capacitor stores up to ~6,000 volts of electricity and is discharged in a 4-microsecond pulse. During discharge, water attempts to expand ~1,800x to convert water into steam, creating shock waves that travel rapidly through the liquid. Coupled with ozone and peroxide, radicals are formed, effective in destroying organic compounds. This paper describes using this technology in an experimental setting for deodorizing agricultural wastes. Preliminary testing has indicated elimination of odors from agricultural wastes within ~15 minutes.

Key words: underwater plasma, advanced oxidation, acoustic cavitation, agricultural wastes