Nominee's Accomplishments

In 1990, Mr Liu was still a undergraduate student in Harbin Institute of Technology, he pressed two pioneer papers on using ultrasonic cavitation as an Advanced Oxidation Proceses(AOPs) for drinking water treatment. At that time, the Sonochemistry (known Cavitation Chemistry) was on the growing up. The first paper: Ultrasonic Cavitation~A Possible Way to Clean Drinking Water was published in Chinese highest impact environmental science journal, *Shanghai Environmental Science* **9**(3), (1990), 39. Five months late, this pioneer paper was abstracted in Chemical Abstract (CA). In 1991, the next paper~Technical Analysis of Ultrasonic Cavitation for Water Treatment was also published in the same journal(**10**(4), (1991), 40-41). After two years, he sent the abstract to a French Chemist J L Luche, Dr Luche began to use ultrasonic cavitation for degradation some toxicants in water. The advancement of this area was developed by M. K. Hoffmann and co-workers. In 1993, Mr Liu sent the abstract to Hoffmann, Hoffman group began to use sonochemistry for degradation several organic toxicants in a near-field acoustic processor and published a series papers in *Environmental Science & Technology*, *Journal of physical Chemistry*. They received award form American Chemical Society: ACS Award for Creative Advances in Environmental Science and Technology by this research work.

Compared with other AOPs, *e.g.* photo-chemical oxidation, sonochemical degradation provides with high efficiency. In 50ml solution, the input sound intensity was $3W/cm^{-2}$, sound irradiation time was 5min, the OH free radical concentration was 10-7M, which was high than ten orders with same input power for photo-chemical reaction(*e.g.* In the same input power, the OH free radical concentration in photo-chemical reaction was only 10-17M). Sonochemical reaction in water can provide with high OH free radical concentration, which can reach to the efficiency of Fenton oxidation.

Compared with Ozone oxidation, in China, 1Kg ozone need 37KWh electric powers, we may calculate the energy using rate to be 7.5×10-6g/J. However, in ultrasonic cavitation oxidation, the H_2O_2 generate rate was $2.2\times10^{-5}M\cdot min^{-1}$ in a $85cm^3$ sonochemical reactor under $1.2W/cm^2$ input sound intensity(see E J Hart and A Henglein *J Phys Chem* **89**(20), (1985), 4342-4347). We can calculate the energy using rate to be $5.4\times10^{-5}g/J$, which is higher one order for ozone oxidation.

Ultrasonic cavitation oxidation in water treatment is an emerging AOPs process in the world. From 1990 to present, including Mr Liu's pioneering two papers, the citation time of this area reached to 30000 times, that is the top citation record in environmental sciences.