
Importance of ozone in water treatment using oxygen plasma

Nozomi Takeuchi ¹, Naoto Ishibashi ², and Hyun-ha Kim ¹

¹*National Institute of Advanced Industrial Science and Technology, Japan*

²*Tokyo Institute of Technology, Japan*

As you well know, OH radicals are produced from water molecules in plasmas in contact with water. The produced OH radicals diffuse into water and can decompose persistent organic compounds such as acetic acid. In this water treatment process, hydrogen peroxide is produced by a self-quenching reaction of OH radicals simultaneously. Hydrogen peroxide acts as a OH radical scavenger, which limits the processing speed and energy efficiency in conventional plasma methods. To utilize the hydrogen peroxide in decomposition of organic compounds, we used plasma generated within oxygen gas bubbles which produces ozone in addition to OH radical and hydrogen peroxide. The oxygen plasma was generated in parallel at 21 small holes through which oxygen gas was supplied into an acetic acid solution. Ballast capacitors were used to control the plasma input power, allowing ozone and hydrogen peroxide to be produced at different rates in each plasma by adjusting the power. By using an ozone absorber connected to the plasma reactor, ozone in the plasma-treated gas was effectively absorbed in the solution, generating OH radicals via bulk reactions with ozone and hydrogen peroxide. This oxygen plasma treatment achieved higher processing speed and energy efficiency for the reduction of total organic carbon compared with other plasma methods.

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