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Relation between total residual oxide (TRO) and redox potential (ORP) in seawater sterilization system based on surface discharge plasma

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This work investigated the sterilization of seawater using surface discharge plasma. In this system, the surface plasma produced ozone and short-lived reactive species which were continuously dispersed and dissolved in the biologically contaminated seawater. The indirect treatment of seawater using the surface discharge plasma increased the concentration of total residual oxidant (TRO) by the reaction between ozone and bromine anion that is abundant in seawater to form hypobromite (BrO-). The hypobromite is the main constituent of TRO and can act as a strong oxidant capable of sterilizing bacteria. The seawater treatment was carried out in a semi-batch system consisting of a 1-L water-jacketed glass vessel and a gas diffuser. The seawater temperature was kept at 20°C. The gas introduced into the surface discharge plasma reactor was oxygen whose flow rate was controlled to 2Lmin-1. The seawater samples taken at a given time interval were mixed with a color reagent, and then the amount of TRO produced by the reaction with ozone was determined using a UV-Vis spectrophotometer at 515nm. The concentration of dissolved ozone and the oxidation-reduction potential (ORP) were simultaneously measured to analyze the relation between ozone, TRO and ORP. It was observed that TRO, ORP and dissolved ozone increased sharply in the early stage, and then the increases were slowed down with the lapse of time. An increase in the discharge power increased both TRO and ORP at the same time, showing a similar tendency. Based on these results, it is possible to relate ORP directly to TRO, which enables us to easily find out the optimal operating condition of the seawater sterilization system.

Biography

Young Sun Mok has completed his BS degree in Chemical Engineering from Yonsei University, Seoul, Korea, in 1989, and the MS and PhD degrees in Chemical Engineering from the Korea Advanced Institute of Science and Technology (KAIST), Daejon, Korea, in 1991 and 1994, respectively. He has been with the Department of Chemical Engineering, Jeju National University, Korea, since 2000. His research interests include applications of non-thermal plasma to pollution (air/water) control, catalysis, energy production, and material syntheses.

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