Experimental investigation of a gas-liquid plasma discharge and its application to water purification

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A gas-liquid plasma discharge is applied for water purification and generation of active species, e.g., ozone, hydroxyl radicals, and oxygen radicals, are investigated in a discharge reactor shown in Fig.1. A pulsed high voltage is supplied with 40ns in pulse duration using semiconductor opening switch diodes. As shown in Fig.2, a discharge mainly occurs within bubbles introduced from the bottom of the reactor. It is demonstrated that the concentration of generated ozone can be increased 10-30 percent by mixing a small amount of helium with oxygen gas. Furthermore, a measurement of optical emission from the discharge shows the presence of the hydroxyl radicals and oxygen radicals. These active species are considered to play important roles in water purification through oxidation processes. In the present experiment, decolorization of indigo carmine solution and sterilization of bacillus subtilis are performed using the discharge.


Fig. 1: Schematic of the water-liquid discharge reactor.

Fig. 2: Photographs of the discharge in an argon bubble taken by a high speed CCD camera.