Optical Properties and Kinetic Behavior of Chlorine in Pure Water and Swimming Pool Water using Surface Plasmon Resonance Technique

Abstract

An optical sensor based on surface plasmon resonance phenomenon for detection of chlorine in pure water and swimming pool water is presented. The measurement was carried out at room temperature using Kretschmann surface plasmon resonance technique. When the air medium outside the metal film is changed to chlorine solution, the resonance angle shifted to the higher value. The shift of resonance angle ($\delta\theta$) increases linearly with chlorine concentration in which the detection limit and sensor sensitivity could be quantified. In this work, the sensitivity of the detection was estimated to be 0.11○/ppm and 0.12○/ppm for Calcium Hypochlorite (G70) and Trichloroisocyanuric Acid (G90), respectively. The detection limit of this sensor is better than 0.1 ppm for chlorine samples and capable to monitor the chlorine concentration in swimming pool. We observed that the shift in the resonance angle ($\delta\theta$) decreases with time due to reducing amount of chlorine in the solution. Result from real-time measurement of swimming pool water was compared with simulation result carried out in the laboratory. Both have shown that the resonance angle decreases with time due to releasing of chlorine gas to the atmosphere.

Keyword: Calcium hypochlorite, trichloroisocyanuric acid, detection limit, sonsor sensitivity, swimming pool water