

Study on the design method of reactor for UV disinfection and the quantitative prediction of its secondary effect.

YASUI Nobuhito

According to "Cryptosporidium countermeasures in waterworks" from the Ministry of Health, Labour and Welfare in Japan, usage of UV was accepted for water sources except surface water. However, since disinfection effects are determined by the UV dose, which is expressed by the multiplication of the UV dose rate and the distributing residence time, in general the prediction of the disinfection effect is difficult.

Moreover, UV disinfection also can generate disinfection by-products as well as chlorine.

The objectives of this study are to establish the design method of UV disinfection reactor and to predict the amount of by-products generated during UV irradiation.

The measurement of disinfection effect and the estimation of residence time distribution were conducted using full-scale UV disinfection reactor. And the disinfection effect was predicted. From the result, it was turned out that disinfection effect can not decide from UV lamp output and flow rate. Moreover, the residence time distribution in the reactor can be expressed by dispersion model. It was considered that the prediction of disinfection effect can be almost estimated, when the residence time distribution and average UV dose rate were used. The predicted value of the disinfection effect using a newly developed modified radial light demonstrated the measured value appropriately rather than with radial light.

The quantitative prediction of secondary effect during UV irradiation was focused on nitrite which may be generated as by-products and the prediction of generation amount of nitrite was conducted. From the result, the generation mechanisms of nitrite can be expressed with the multiplication of the initial nitrate concentration and UV dose. When the initial concentration of nitrate was 10 mg/L of the water quality standard for drinking water using low-pressure mercury lamp, UV dose over about 1800 mJ/cm² is required for exceeding 0.05 mg/L which is the guideline value of nitrite.