Development of measurement method of chlorinous odor in drinking water and study on decreasing of chlorinous odor through a pilot plant investigation

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1. Background and Objectives

Many people do not drink tap water directly in Japan because of chlorinous odor[1]. The strength of chlorinous odor can be evaluated by the olfaction test. However, the chlorination conditions of measuring chlorinous odor have not been established. Therefore, the optimization of these conditions (e.g., reaction time) for evaluating chlorinous odor formation potential is necessary.

The compounds causing chlorinous odor are generated by the reaction between chlorine and dissolved nitrogen compounds. Hence, one way is to remove chlorinous odor is the removal of these precursors. In this study, after establishing the reaction conditions for chlorinous odor formation potential, the performance of ion-exchange treatment and advanced oxidation process was evaluated in a pilot scale plant for the minimization of chlorinous odor.

2. Measurement method of chlorinous odor formation potential

The relationship between odor strength and residual free chlorine, and that between odor strength and reaction time were investigated using ozone / GAC treated water. Odor strength increased with increasing residual free chlorine concentration for the same reaction time. The upper limit of residual free chlorine concentration in actual situation is 1.0 mg/L in Japan. Therefore, chlorinous odor formation potential should be measured for a chlorine residual of 1.0 mg/L. Also, odor strength of 6 hours showed higher values than those of after 24 hours. Therefore, chlorinous odor formation potential was defined as the odor strength after 6 hours of chlorination with a chlorine residual concentration of 1.0 mg/L.

3. Decreasing of chlorinous odor by oxidation process and ion exchange in a pilot plant of water treatment

The chlorinous odor strength and ammonium ion concentrations were investigated and compared under ozonation and advanced oxidation processes (AOP). Among ozone and advanced oxidation processes (AOP), ozone / hydrogen peroxide / ultra violet radiation process was the most effective process in reducing chlorinous odor strength. In addition, ion exchange was found to be effective for removing the ammonium ion, and decreasing chlorinous odor formation potential. Furthermore, the combination of ozone / hydrogen peroxide / ultra violet radiation / granular activate carbon / ion exchange process could reduce chlorinous odor (under 0.2 mg/L residual free chlorine) to 7-30 TON. Also, relationship between odor strength and temperature was investigated, and then, odor strength would be 4 TON (target odor strength) at 16.5 °C. This result implies ozone / hydrogen peroxide / ultra violet radiation / granular activate carbon / ion exchange treatment under 0.1 mg/L residual free chlorine could achieve 4 TON in nearly 162 days in one year.

Reference

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