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REDUCTION OF TRIHALOMETHANES IN WATER TREATMENT BY REPLACING SODIUM AND CALCIUM HYPOCHLORITE FOR ADVANCED CHLORINE- FREE OXIDATION PRODUCTS

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The generation of trihalomethanes (THM) in water treatment stations such as by-products of disinfection and pre-oxidation with chlorine compounds is a frequent problem all over the world. The surface raw water contains fulvic and humic acids, which with their ketone radicals, can form haloforms in reaction with chlorine, generating trihalomethanes considered carcinogenic and an environmental pollutant. The four main groups of chlorine compound disinfection by-products are: chloroform (CHCl₃), bromoform, (CHBr₃), bromodichloromethane (CHBrCl₂), and dibromochloromethane (CHBr₂Cl) (THM₄ total).

The allowed THM limit for drinking water in Brazil is 100 µg/L (ppb) and in USA is 80 µg/L.

This paper evaluated the total THM generation in a surface water treatment station, located in state of São Paulo (Brazil) with the replacement of sodium hypochlorite and calcium hypochlorite for the advanced oxidation agent *Proxxis*, composed of peracetic acid and additives.

The entrance water was analyzed and with total THM values <1.0 µg/L. Before replacing for *Proxxis* in pre-oxidation, a series of jar-tests were executed aiming to reduce the dose of hypochlorite (sodium and calcium), with concentrations varying from 6.71 to 3.73 ppm active, compensated by adjustments in the polyelectrolyte, coagulant composed of polyaluminum chloride (PAC) and pH. The best results still showed the high presence of THM₄ (153.2 µg/L) in addition to the expected reduction in pH, increased demand for alkalinity and residual aluminum. These results, therefore, were not satisfactory.

Tests made directly at the water treatment station itself, with water discharge, reached

582 µg/L of total THM₄, the results of the study with sodium hypochlorite were very close to the calcium hypochlorite, with an average of 235 µg/L. The best results with chlorine compounds were 89.1 µg/L, although with loss of treated water quality for the other parameters, therefore being considered unsatisfactory.

Based on these results, sodium and calcium hypochlorite were replaced by *Proxxis*, with dosages of 1.5 to 3.0 mg/L, keeping the polyelectrolyte and coagulant (PAC) *Ecofoc* WI 18%. The results demonstrated the immediate reduction of the total THM₄ to <8.0 µg/L, which is at least 12.5 times lower than the limits for potability.

The results showed the great efficiency of THM reduction in surface water with the use of an advanced oxidative agent *Proxxis*, with THM reduction efficiency higher than 99.0%, maintaining the quality of the treated water, correcting one of the most common problems in water treatment to achieve the potability limits.