

B-25 SOLUBILITY OF COMMERCIAL ORGANIC AND INORGANIC CHLORINE  
TABLETS IN DISINFECTION CHAMBER OF JOHKASOU

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## 1. Introduction

Chlorine tablets are used for disinfection of the biologically treated wastewater in Johkasous. The solubility of these tablets in Johkasous under different circumstances is important because of its relation to the disinfection properties of the tablets.

To evaluate the solubility of the tablets in Johkasous, different factors which affect it have been investigated. Two kinds of tablets, organic and inorganic, were used. A disinfection chamber of a real Johkasou was used. A reservoir of tap water was attached to the chamber to simulate the water flow from the sedimentation chamber to it. A modified model of daily flow rate was applied and chlorine concentration was measured.

## 2. Materials and Methods

Organic tablet composed of trichloro-isocyanic acid (15 gm/tablet) and inorganic tablet composed of calcium hypochlorite (20 gm/tablet) were used. Chlorine demand free water in beakers and small portions of tablets were used for the preliminary experiments. Tap water (residual chlorine 0.29-0.35 mg/l) was used for experiments using disinfection chamber of Johkasou. Chlorine concentration was measured by DPD method (HACH DR/3000 spectrophotometer).

In the preliminary experiments, 200 ml of chlorine demand free water with 0.5 gm of each kind of tablets were used. Effects of stirring velocity, temperature and pH of the water were investigated.

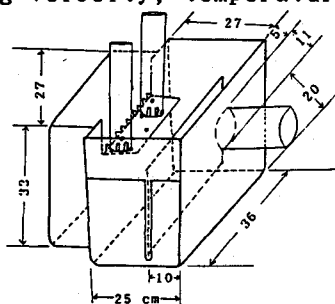


Fig. 1 Disinfection chamber of Johkasou

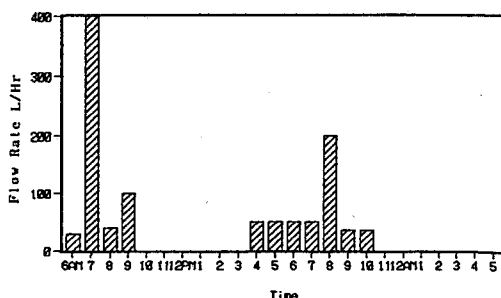


Fig. 2 Modified model of daily flow rate in 24 hrs.

Experiments advanced to study the solubility of whole tablets in the disinfection chamber of a Johkasou (Fig.1). As a first step, solubility of one tablet was examined. Then, two columns containing the tablets were used to simulate the phenomena in field Johkasou. One and two layers of the tablets were also used to study the solubility of tablets which are not in contact directly with flowing water.

Different flow rates using a modified model of flow pattern obtained from six different cases were applied (Fig 2). This model was thought to reflect the normal daily life. The highest flow rate in

this model was 400 l/hr at the early morning, about 200 l/hr at the evening and between 100 and 35 l/hour through the day.

### 3. Results and Discussion

#### 3.1 Preliminary experiments

Fig.3 shows that, inorganic tablets are highly soluble than the organic one. The inorganic tablets turned the pH of neutral water to alkaline (more than 10 after one hour contact time) and organic tablets turned it to acidic (less than 4 after one hour). Fig.4 shows that, higher temperature increased the solubility of the organic tablets while its effect on the inorganic tablets was not remarkable. The solubility of the organic tablets increased in alkaline and acidic medium than in normal pH water. While the solubility of inorganic tablets was higher in acidic medium and lower in alkaline medium than normal pH water.

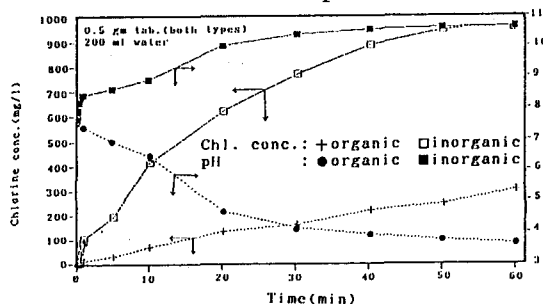


Fig. 3 Comparison between solubility of organic and inorganic tablets and changes of pH of water in both cases

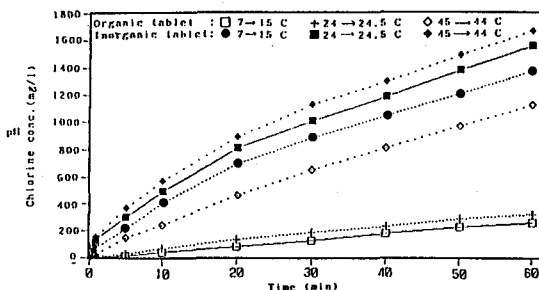


Fig. 4 Effect of temperature on the solubility of organic and inorganic tablets

#### 3.2 Experiments using disinfection chamber of Johkasou

One tablet was used to get the fundamental data about the relation between flow rate and the solubility of the tablets. Fig.5 shows that, the solubility of organic tablets increased steadily with lowering the flow rate and vice versa. While with inorganic tablets, this relation was not constituent as shown in fig.6. The soluble pattern depended on the condition of the tablet. If the tablet was new, the chlorine concentration was very high at the beginning of contact even if the flow rate was high. When the time advanced, the chlorine concentration started to decrease.

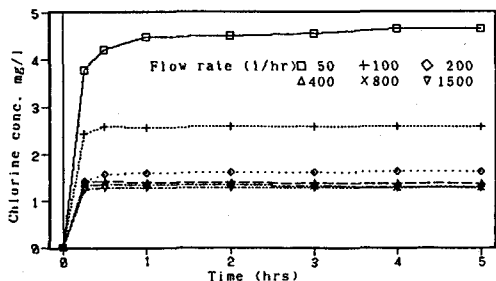


Fig. 5 Solubility of one organic tablet in the disinfection chamber under different flow rates

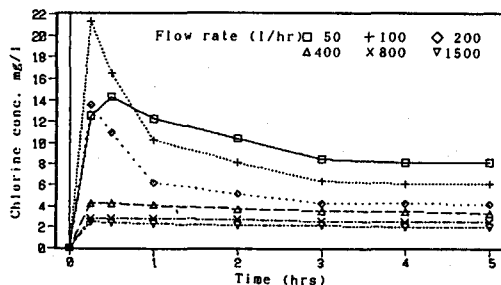


Fig. 6 Solubility of one inorganic tablet in the disinfection chamber under different flow rates

One column containing one layer of five tablets and two layers (10 tablets) was used to study the effect of layers of tablets on the chlorine concentration of effluents. The results show that there was no remarkable difference in both cases and in both kinds of the tablets (Fig.7 and Fig.8).

The results of using two columns, containing 5 tablets in each, to simulate the field Johkasou, show that the solubility of organic tablets was higher in the summer, by the rate of 50% of more, than the winter (Fig. 7). But for the inorganic tablets, the difference is limited.

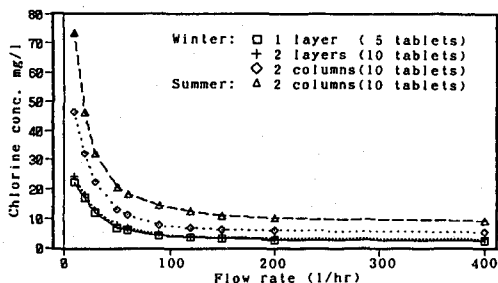


Fig. 7 Relationship between flow rate and chlorine concentration in disinfection chamber on Johkasou (organic tablets)

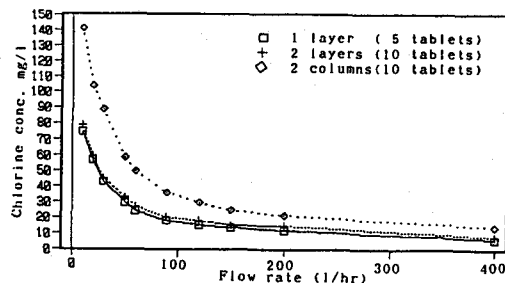


Fig. 8 Relationship between flow rate and chlorine concentration in disinfection chamber on Johkasou (inorganic tablets)

When the time passed, there was no remarkable difference in chlorine concentration with the same flow rate in case of organic tablets. The size of the organic tablet shrunk regularly from all sides. While with inorganic tablets, the side which faced the water flow shrinks and the other sides didn't change. In the following days, the chlorine concentration in the effluent decreased gradually with inorganic tablets.

Fig. 9 and fig. 10 show the effect of changes in flow rate on chlorine concentration in case of organic and inorganic tablets respectively. When the flow rate changed from low to high, the chlorine concentration decreased sharply in both cases and then become stable. When the flow rate changed from high to low, the chlorine concentration increased slowly.

When the flow started again after overnight stop, the chlorine concentration increased sharply with inorganic tablets. While with organic tablets, the difference was limited.

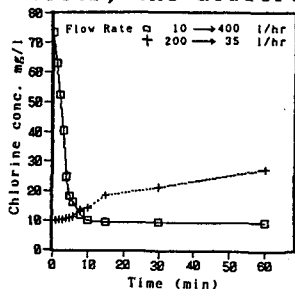


Fig. 9 Effect of changes in flow rate on chlorine concentration with organic tablets.

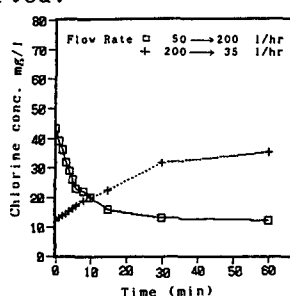


Fig. 10 Effect of changes in flow rate on chlorine concentration with inorganic tablets.

#### 4. Conclusion

Inorganic tablets are highly soluble than the organic tablets. Organic tablets turn the pH of water to acidic while inorganic tablets turn it to alkaline. High temperature increases the solubility of both kinds. pH of the medium affects the solubility of tablets. The relation between flow rate and chlorine concentration of Johkasou effluent is stable when using organic tablets. In case of inorganic tablets, this relation changes due to difference in solubility from one day to another.

The experiments show that, with organic tablets, the chlorine concentration of 10 mg/l which is required in Johkasou effluent, could not be obtained in high flow rate especially at the winter. While with inorganic tablets, this concentration could be obtained easily.