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II－614 **DIRECT FILTRATION OF SECONDARY WASTE WATER EFFLUENT BY A DUAL MEDIA FILTER**

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1. INTRODUCTION

During the past 30 years, the direct filtration process has been used for the water treatment as well as for the waste water treatment with low turbidity i.e. less than 10 mg/L. To prevent the fast build-up of the filter bed, a dual media with coarse medium at the upper part and sand at the lower part has been proposed.

The objectives of this study is to investigate the turbidity removal of the waste water effluent and to estimate the coefficient of the filter bed by means of the direct filtration process.

2. EXPERIMENTAL APPARATUS AND METHODS

As shown in Fig 1, the experimental apparatus consists of a feeding system , one rapid-mixing tank, a head tank, two 7.5 cm interior diameter columns A and B and a water manometer board. In the column B, a 90 cm coarse medium bed is housed in the upper part and in the lower parts of both columns, an identical 60 cm sand bed is housed. The coarse medium consists of a semi-cylindrical vinyl composite with a 2 mm interior diameter and a 4 mm exterior diameter. The sand size range is 0.59 mm ~ 0.71 mm.

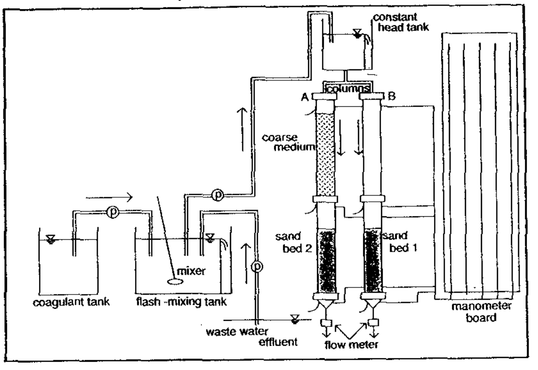

Fig.1:Experimental Apparatus

In order to compare the run time of the two media, the experiments were first performed until the available head loss of 330 cm was reached and then the filters were run for 8 hours when the coagulant was added. Hourly, samples were taken in order to have an average solution.

The filtration experiments were performed at a constant rate of 120 m per day (0.42 L/min.) and the flow was manually controlled by continuous adjustment of the downstream valve.

$Al_2(SO_4)_3 \cdot 18H_2O$ was used as coagulant at the concentrations of 1 ,2 and 4 mg Al/L. The pH of the filter effluent ranges between 6.5 and 7.4. These experiments were performed without pH control.

3. RESULTS AND DISCUSSION

From Fig 2, the run time for the single sand bed medium is 5 hours whereas it is 23 hours for the dual-media filter. The incremental head loss for the coarse medium is only 3 cm whereas for the sand bed it is 245 cm.

From Fig 3, 47% to 72% of the turbidity is removed in the coarse medium bed whereas 11% to 30% is removed in the sand bed . The turbidity of the sand bed effluent is almost 2 mg/L.

According to the head loss curves in Fig 4 , the patterns of the filter clogging are the same for both Sand bed 1 and Sand bed 2. For the same run time of 23 hours, the amount of deposited solid in the coarse media is 3 times as much as that of the sand bed 2.

We can see from Fig 5 that the filter coefficient of sand bed 1 ranges from 2.3 to 3 per meter and the filter coefficient of the coarse medium and sand bed 2 range from 0.9 to 1.5 per meter. The filter coefficient and the sand bed 2 turbidity effluent are almost constant regardless the alum concentration increase. But the head loss increases as the coagulant dosage increases.

The Fig 6 figure shows the results of a jar test analysis. A period of 5 minutes was allowed for rapid mixing at 120 rpm, followed by 30 minutes of flocculation at 50 rpm and 30 minutes of sedimentation.

The optimum pH for turbidity and color removal ranges between 5.5 and 6.

During the filtration, no color removal occurred without coagulation, but color removal may occur when coagulant is added.

4.CONCLUSIONS

From this study, the following conclusions can be drawn:

1- The dual media filter has a filter run 4 times as long as that of the single sand-bed filter.

2- The turbidity of the filter effluent is almost constant regardless the increase of the alum dosage.

3-Without coagulant, the filter run time is longer than the cases where coagulant is added.

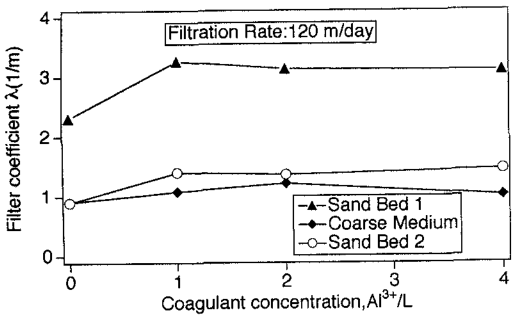

Fig.5:Average Filter coefficient versus Alum concentration

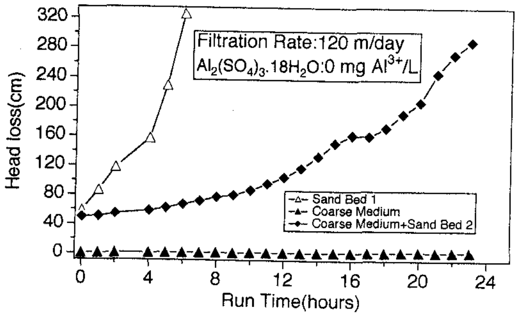

Fig.2:Head loss versus Run Time

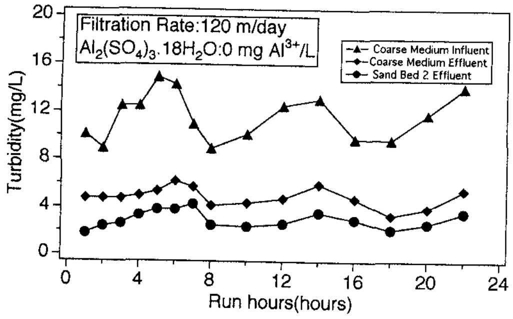

Fig.3:Turbidity versus Run Time

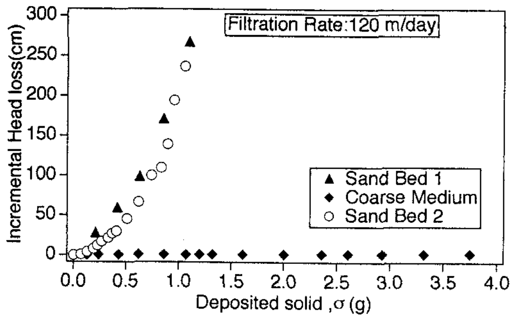

Fig.4:Incremental head loss versus Deposited solid

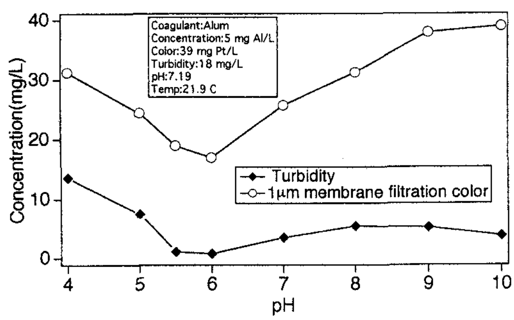

Fig.6:Turbidity and Color concentration versus pH

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