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SANITATION AND WATER FOR ALL

Pre-treatment for slow sand filters

Dr Waris Ali, Pakistan

SLOW SAND FILTERS ARE being used for the treatment of surface waters in many areas of Pakistan. Most slow sand filters draw water from irrigation canals. To ensure supplies during the canal closure period, storage tanks with a capacity equivalent to 21 days of supply are provided. The raw waters are highly turbid and cannot be treated effectively with slow sand filters without proper pre-treatment. The results of the studies of the operating slow sands filters in selected communities show that many of these filters have short filter run lengths besides producing turbidity in excess of the WHO guideline value for drinking water (Lillah, 1987; Durrani, 1992). The evaluation of the results shows that in most cases the storage tanks are unable to produce water suitable for treatment by slow sand filters suggesting additional pre-treatment (Ali and Tariq, 1987). This paper evaluate the effectiveness of Horizontal Flow Coarse Media Filter (HFCME) as a pre-treatment method for slow sand filters treating different types of raw waters.

Methodology

The performance of Horizontal Flow Coarse Media Filter (HFCMF) has been studied at laboratory scale. The filter consists of a rectangular box 6 m long, 0.3 m wide and 0.3 m deep. The filter media consisting of crushed stone of graded size was packed into three compartments from coarse to fine in the direction of flow as shown in Fig.1.

The filter has been operated at filtration rates of 0.5 m/h and 1.5 m/h. In Phase-I of the study local natural clay has been used to prepare the raw water whereas in Phase-II of the study fine commercial clay has been used. In phase-III, the suspension prepared using the commercial clay was pre-treated with a vertical flow roughing filter to change the size of the particles being fed to the HFCMF. Tap water was used to prepare the turbidity suspensions in all the cases. The details of filter operation are provided by Ali (1997).

Samples of water at the inlet, outlet, and ports at the end of each compartment were collected three times a day for turbidity measurements. Samples integrated over 24 hours were also collected daily at the outlet for turbidity measurements.

Results and discussion

The results of the performance of the horizontal flow coarse media filter during the Phase-I studies are shown in Fig 2. The inflow turbidity ranges from 47 to 190 NTU. The filtered water turbidity is from 1 NTU to 7 NTU indicating good performance of the unit. Compartment 1 having coarse media of 25 mm size can be noted to be most effective in terms of turbidity reductions.

The filter was operated using different turbidities between 100 NTU and 200 NTU at different rates of filtration in Phase II of the study. The results are shown in Figs 3-4. The filtered water quality is from 4 to 7 NTU which meets the requirements of inflow water for a slow sand filter.

In Phase III of the study, HFCMF was operated at filtration rates of 0.5 m/h and 1.5 m/h with an average inflow turbidity of about 100 NTU which resulted from the operation of the pre-filter being fed with raw water of about 200 NTU. The results are given in Figs. 5 and 6. The outflow turbidity from the HFCMF were noted to be about 5 NTU and 8 NTU for the filtration rates of 0.5 m/h and 1.5 m/h respectively. It may be noted that the outflow turbidity is low enough for use as an inflow to the slow sand filters.

Figure 1. Schematic diagram of HFCMF

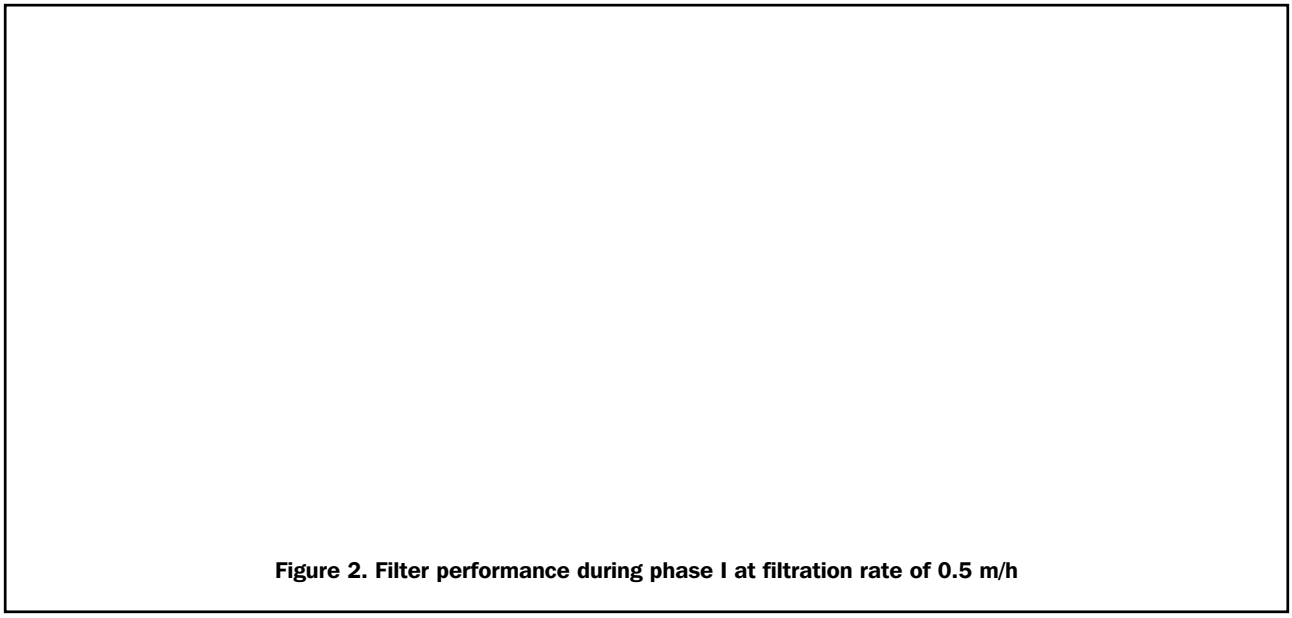

Figure 2. Filter performance during phase I at filtration rate of 0.5 m/h

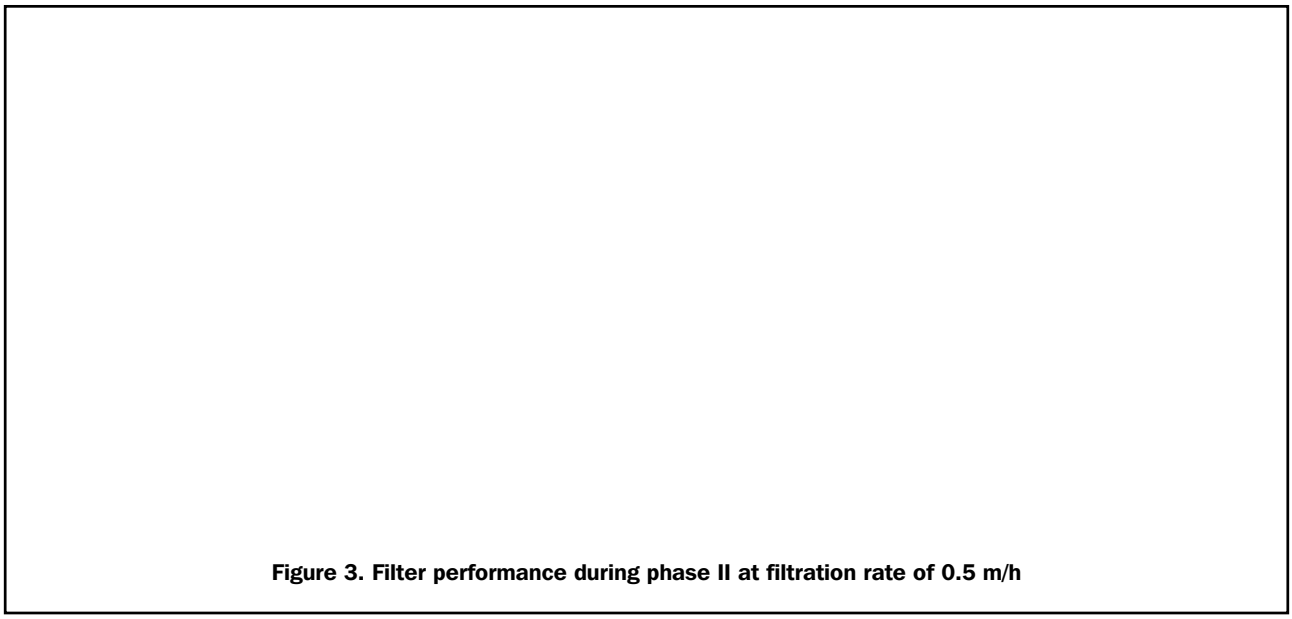

Figure 3. Filter performance during phase II at filtration rate of 0.5 m/h

Conclusions

The results of the operation of the horizontal flow coarse media filter treating different types of raw water at various rates of filtration show that increasing the rate of filtration increases the outflow turbidity. Similarly when the turbidity of the raw water is higher, the resultant treated water turbidity is also high. Using the pre-treated water as an inflow results in outflow turbidities which are only marginally high. However in all the cases the effluent turbidity has been found to be between 3 NTU and 8 NTU. These turbidity values are within the range acceptable for use as an inflow for slow sand filters. This suggests the suitability of horizontal flow coarse media filter as a pre-treatment method for slow sand filters. It is, however, recommended that pilot scale studies be conducted using natural water in order to confirm their applicability under the field conditions.

References

ALI, W., 1997. *Horizontal Flow Coarse Media Filtration Study*. IEER Report No. 058-03-97. Institute of Environmental Engineering and Research, University of Engineering and Technology Lahore.

ALI, W. AND TARIQ, M. N., 1987. *Slow Sand Filtration and Pre-Treatment*, IPHER Report No. 053-09-87. Institute of Public Health Engineering and Research, University of Engineering and Technology Lahore.

DURRANI, W. Y., 1992. *Investigations on Performance and Upgradation of Slow Sand Filtration Plants in Multan Area*, M. Sc. Thesis, IPHER, University of Engineering and Technology Lahore.

LILLAH, A. S. K., 1982. Study of the Performance of Slow Sand Filters under Local Conditions. M. Sc. Thesis, IPHER, University of Engineering and Technology Lahore.

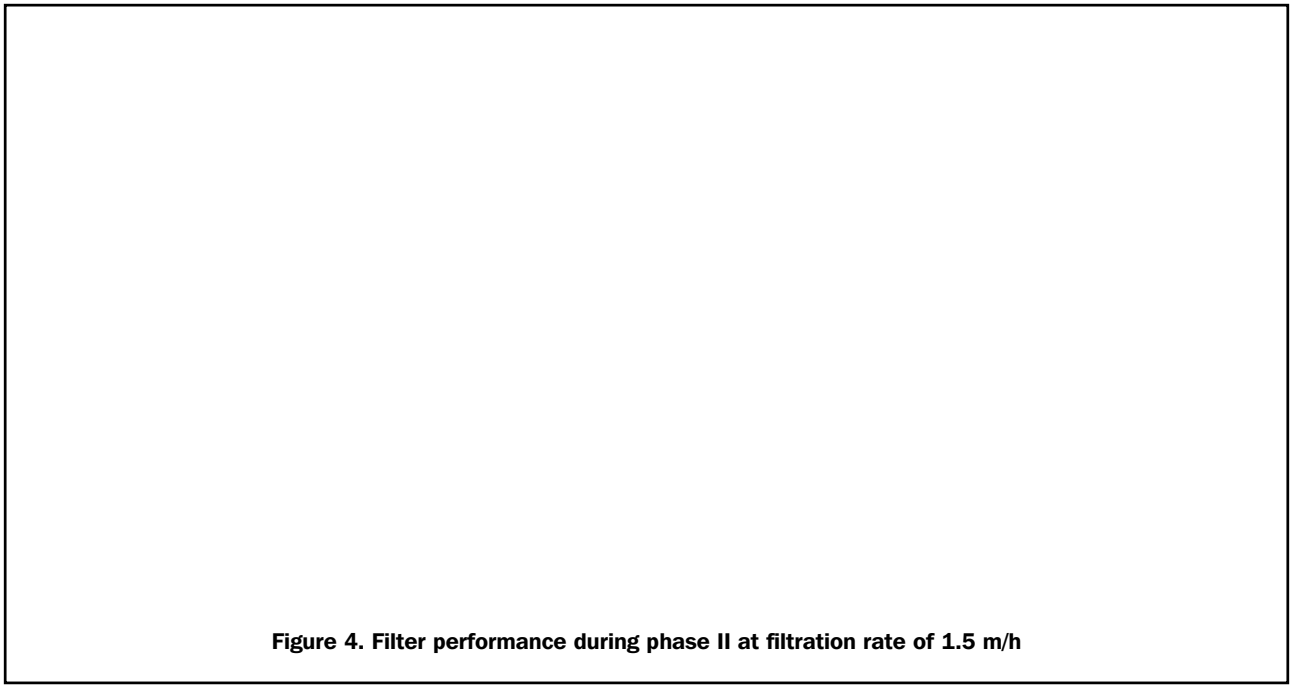

Figure 4. Filter performance during phase II at filtration rate of 1.5 m/h

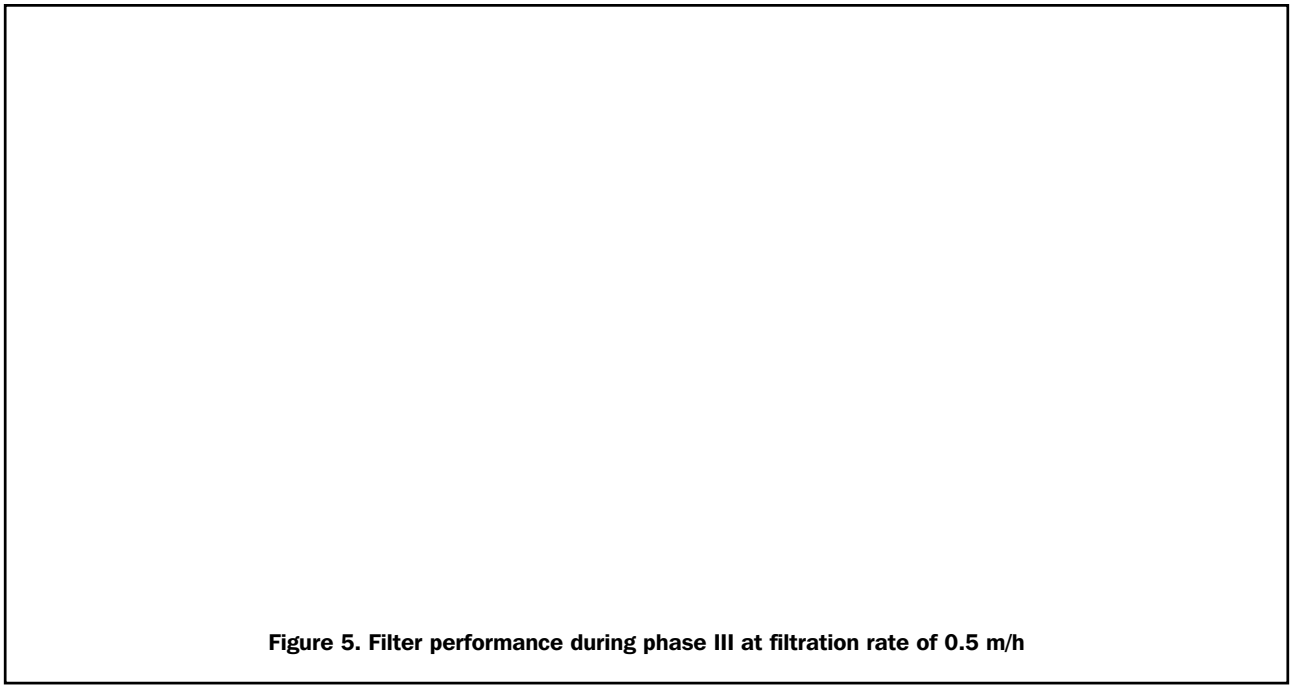

Figure 5. Filter performance during phase III at filtration rate of 0.5 m/h

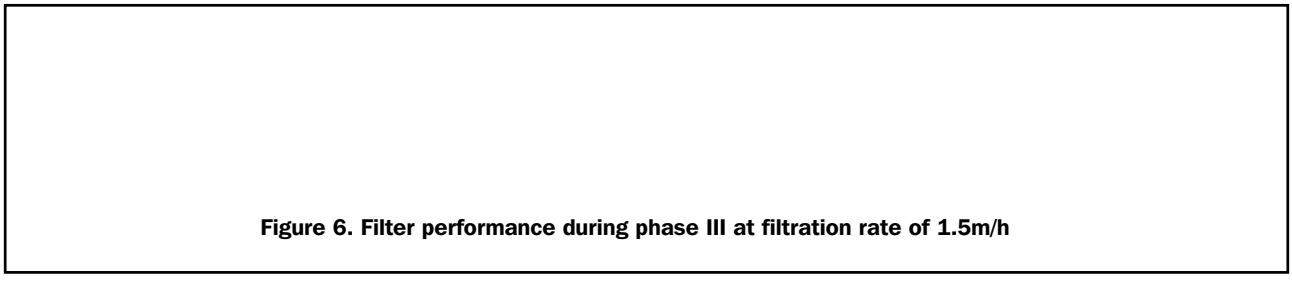

Figure 6. Filter performance during phase III at filtration rate of 1.5m/h

DR WARIS ALI, Professor, Institute of Environmental Engineering and Research, University of Engg. and Tech., Lahore, Pakistan.