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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Water treatment

Optimising design and operation of high-rate clarifiers

A completed WRC project illustrates the benefits and constraints of high-rate clarifiers.

Background

High-rate processes are critical, especially where capital spending cannot keep pace with the increasing water demand. Despite high-rate clarification technologies being widely used in First World nations for potable water treatment, these technologies are scarcely applied in developing countries.

This may in part be due to a lack of knowledge or of knowledge dissemination on the performance capabilities, as well as the operational and maintenance requirements of high-rate clarifiers. This study was initiated with the intention of contributing to bridging this knowledge gap.

The main aims of the project were to contribute to the current understanding of the operational, maintenance and process requirements and limitations for high-rate clarifiers, based on investigations conducted on a demonstration plant; and to provide practical guidance on the selection, design and operation of high-rate clarifiers, with particular reference to the investigations carried out on the demonstration model.

Methodology

Several common high-rate clarification technologies were investigated under the WRC study. This included the so-called HR-CSAV (a sludge blanket clarifier which uses a flocculant aid), ballasted sand processes and sludge recirculation processes. This was supported by plant visits to provide case studies for existing full-scale facilities using these technologies, both in South Africa and abroad.

Then high-rate clarification technology was evaluated based on investigations conducted on a demonstration unit. The HR-CSAV technology was purchased for this purpose.

For comparison, the clarifier was operated at two water treatment facilities, one using an impounded raw water source with low raw water turbidity, and the other using river water abstraction with more variable raw water turbidity (up to 157 NTU). In addition, the demonstration model high-rate clarifier was operated in parallel with conventional clarifiers.

Results and conclusions

Results from the investigations on the demonstration model high-rate clarifier operating in parallel with conventional clarifiers clearly showed that similar clarified water turbidity may be achieved by the high-rate clarifier, which was operated at 7 m/h. Slow floc settling rates and an increase in settled water turbidity occurred when using low turbidity raw water.

The higher operating rates of the high-rate clarifier and its sensitivity to the chemical dosages applied make it less forgiving to poor process monitoring and control compared to conventional clarifiers. The automation of chemical dosing systems, as is common for conventional processes, would allow for more prompt response to fluctuations in raw water quality.

It was evident from the case studies and the operation of the demonstration model that high-rate clarification processes are specialised technologies and, therefore, require more operator judgement and more instrumentation and control than conventional clarification processes. The intensive maintenance nature of these processes call for the regular presence of maintenance personnel and, in some instances, that standby treatment units be available during these maintenance shutdown periods.

Therefore, while higher clarification rates are achievable investment in this technology also requires additional investment in a reliable asset management team and skilled operators which are fundamental for the successful operation of these units.

In general, the technology still holds promise as an attractive technology for developing countries to meet the growing potable water demands, provided that there are adequate training and support services made available by the technology provider. This would allow for the process to be successfully operated and maintained after installation.

Further reading:
To order the report, *Operational and design considerations for high rate clarifiers in the South African water treatment industry* (**Report No. 1942/1/13**) contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za, or Visit: www.wrc.org.za to download a free copy.