Alternative Filter Media for Potable Water Treatment

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Abstract

Rapid filter (RF) processes for drinking water treatment traditionally use sand media either in a roughing filtration stage (prior to secondary filtration), or as a primary treatment process following coagulation and clarification processes. However sand-only media in roughing filters treating eutrophic storage reservoir water is vulnerable to rapid clogging during algal bloom periods. It is also quick to biologically foul when filter backwash design is sub-optimal (Fitzpatrick *et al.*, 2004), as is often the case for water utilities that have inherited older works. Dual media filters comprised of anthracite and sand media were developed to extend run times and improve resilience to algal laden influent water (Cleasby 1990). At older works, where RF design limitations prevent use of dual media, filter productivity remains restricted by use of sand-only media. To make better use of the existing assets, Thames Water Research and Development have extensively tested alternative filtration media at pilot scale (Bayley *et al*, 2005, Mikol *et al.*, 2007a *in prep.* & Mikol *et al.* (2007b) *in prep.*). This research sought to:

- Identify suitable mono media replacements for sand-only RFs at sites where backwashing is sub optimal and the filter design does not allow installation of a dual media. Success criteria included: extended run time, greater resilience to algal laden influent water and equivalent (or improved) filtrate quality.
- Determine whether an alternative dual media filter to anthracite / sand could be developed for use in roughing filters prior to slow sand filters, with the aim of increasing productivity and realising energy and water savings (via less frequent backwashing), whilst still producing filtrate of acceptable quality.

Pilot trials compared conventional sand and anthracite / sand media alongside crushed recycled glass and a dual media comprised of two layers of expanded clay. Quality and hydraulic performance parameters were monitored. Media samples were also analysed using scanning electron microscopy (Figure 1.1). Results identified viable alternative media (Figure 1.2) and a full scale trial began in a single RF in late 2006. Additional full scale trials are programmed for later in 2007. The full paper will present performance data spanning 12 months at pilot scale and 6 months at full scale.

Keywords filtration, dual media, expanded clay, glass, sand, anthracite

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Figure 1.1 Scanning Electron Micrograph of sand media after 8 months installation in a pilot scale roughing filter. Biofilm growth is restricted to the pitted areas presumably due to protection from shear during filtration and from abrasion during washing.

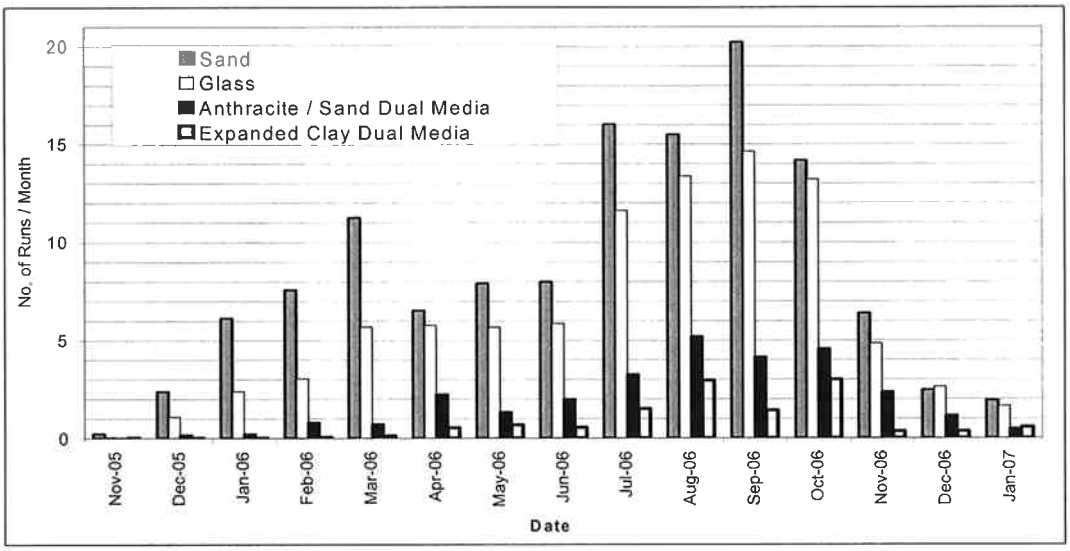

Figure 1.2 Numbers of runs per month for each medium tested at pilot scale, November 2005-November 2006. Fewer runs/month indicates lower rate of head loss development and hence less frequent requirement for backwashing (i.e. favourable in terms of filter productivity and in terms of energy and water conservation).

References

Bayley, R.G.W. Chipps, M.J. Steele, M.E. White, R. Mikol, A. and Fitzpatrick, C.S.B. (2005) Alternative low density media for use in biological roughing filtration prior to slow sand filtration, in Gimbel, R. Graham, N.J.D. & Collins, M.R. (Ed.s) *Recent Progress in Slow Sand and Alternative Biofiltration Processes,* IWA Publishing, 460-464.

Cleasby, J.L. (1990), Filtration. In Pontius, F.W. (Ed.) *Water Quality and Treatment: A Handbook of Community Water Supplies*, American Water Works Association (4th Edn.), McGraw-Hill, NY.
Fitzpatrick, C.S.B. Chipps, M.J. & Palupi I. (2004) Optimising backwash of a fouled filtration medium, *Proceedings for AWWA Water Quality Technology Conference* (WQTC), San Antonio, TX, USA
Mikol, A. Fitzpatrick, C.S.B. Chipps, M.J. Bayley, R.W. and Steele, M.E. (2007a) Novel Dual Media Combination for Drinking Water Treatment. *Proceedings for IWA International Conference on Particle Separation*, Toulouse, in preparation
Mikol, A. Fitzpatrick, C.S.B. Chipps, M.J. Bayley R.G.W. and Steele, M.E. (2007b), Assessment of biomass activity in a novel dual media combination for drinking water treatment, *Proceedings for AWWA Water Quality Technology Conference* (WQTC), Charlotte NC, USA, in preparation.

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