

Drinking Water Arsenic Removal

Dear friends,

In this issue we would like to introduce you arsenic removal technologies of Severn Trent, our special partner for drinking water treatment technologies.

Besides of special solutions for waste filtrations and disinfection is Severn Trent technology leader in removal of arsenic from drinking water. Arsenic content is general problem of our entire region. This is why this Unique solution offering high effect for reasonable price should be interesting for our client.

Background: With increasing regulation and revised compliance dates – UK, December 2003 effective and U.S., January 2006 nearing – to meet reduced levels of arsenic contamination in drinking water supplies, the global water treatment market has been tasked with finding commercially available technologies suitable for treating and removing this contaminant to levels of 10 µg/l. At Severn Trent, initial evaluation of arsenic removal technologies centered on aluminum adsorption, ion exchange, reverse osmosis and coagulation filtration, which were thought to be the best suited for this application. However, through detailed lab, pilot and full scale research; adsorption, and more specifically the use of iron oxide adsorptive media has proven itself as a viable technology for reducing arsenic levels across varying drinking water supplies.



At the onset, Severn Trent approached Bayer AG, Germany, to collaborate in having Bayer AG develop a media that could be used to treat high levels of arsenic at 16 of their drinking water well sites. After successful lab and pilot plant testing of various different iron oxide media samples, Bayoxide® E33 presented itself with the most important aspects of a viable iron oxide media, namely: it has a high capacity for arsenic, is mechanically robust, is stable with a uniform grain size, has a low leaching potential, has minimal head-loss build-up and is immediately effective in a start-stop process. At full scale, the arsenic adsorption process was named SORB™ 33. The SORB™ 33 system has a relatively small footprint, an advantage that makes it suitable for retrofitting or upgrading existing treatment plants, at sites with high levels of arsenic.

Bayoxide® E33 media has a comprehensive and proven history in the drinking water market for successfully removing arsenic levels to below 10 µg/l. The commercial existence and long-term success of this media is further complemented by the ever-growing knowledge base for how this adsorptive media works and the necessary

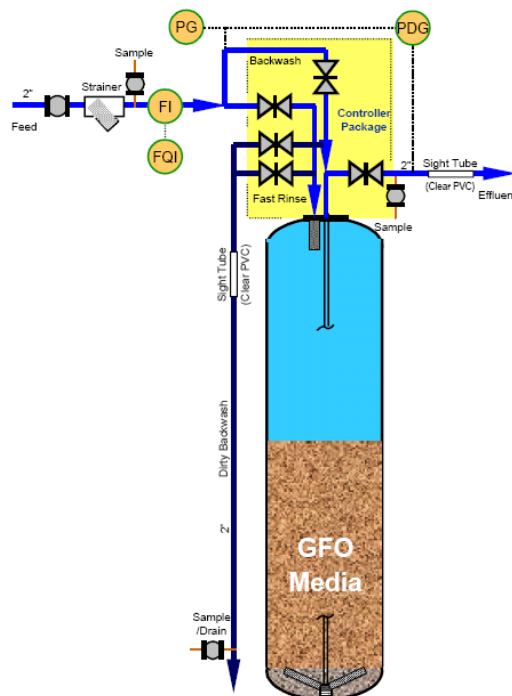
refinements to its use in the adsorptive process. Additional research is focusing on improving the Bayoxide® E33 media in order to manage difficult water qualities and increase process efficiencies.

Findings and Results: After Bayer AG's completion of laboratory tests and making refinements to the Bayoxide® E33 media to optimize performance, pilot plant work was initiated by STW. Research was conducted in the UK to study the chemical properties of Bayoxide® E33. This work included the study of arsenic removal rates, effect of pH, pre-oxidation requirements, impact on disinfection and the effect of other ions. Understanding the effects of other ions is important to the design of an adsorption process because water sources that contain iron, manganese, phosphate, silica, sulfate and vanadium, have been shown to affect process performance.

Hydraulic performance was also studied; looking at media grain size, empty bed contact time (EBCT), head-loss, differential pressure, bed expansion and backwash volume requirements.

Laboratory adsorption testing was conducted in the U.S. on waters with more complex quality, i.e., those with high levels of ions which interfere with adsorption performance and the results were subsequently incorporated into a mathematical model. This model predicts the performance of the Bayoxide® E33 media on more complex waters as experienced in the U.S.

During the Bayoxide® E33 media implementation period, optimization of the SORB™ 33 process was on-going. This resulted in a reduction in the frequency of service washing and the volume of water used together with the ability to reclaim the service wash water by returning it to the plant inlet. Media change-out has also been streamlined. In the U.S., nine municipal well water arsenic removal plants have been built in eight different states. As more arsenic removal systems are scheduled to be designed and built in the U.S., emphasis is being placed on alternative adsorber vessel configurations and where applicable, pre-treatment is being considered to optimize the media's performance.



Significance of Findings: Many years of experience in the arsenic removal market has brought about the realization that while the Bayoxide® E33 iron oxide media is a viable product with a high capacity to remove arsenic contamination in potable water sources, continuous improvement is essential. To this end, Bayer AG has developed a pelletized version of their media which is currently undergoing full scale evaluation at one of Severn Trent's well water sites; having completed a successful one year pilot study. The trials to date have shown that the pelletized version of

the Bayoxide® E33 media has the same high capacity for arsenic removal as the original media, its handling is better, it has lower associated fine levels with low solids release during backwash and it remains 'dust free' when being loaded into a vessel in the dry state.

In addition, the composition of a new media addresses the problems posed by complex water sources in both drinking and non-drinking water applications. Some of the advantages of this new media are predicted to include a higher capacity for arsenic adsorption together with greater robustness. The new media composition, which has increased adsorption capacity and faster kinetics, will help to address difficult water qualities, e.g. non-drinking water, where high concentrations of arsenic and heavy metals may occur. A media with a higher mechanical stability leads to better handling and overall process efficiencies. Pilot plant testing on this new media is about to be undertaken.

In addition to testing media variations, Severn Trent is evaluating the ability of Bayoxide® media to simultaneously reduce iron and manganese levels concurrently with arsenic removal. Pilot plant work and full scale implementation of the SORB™ 33 process has shown that iron and manganese can be filtered out in the adsorption process since the Bayoxide® media is robust enough to withstand higher differential pressures and an increased frequency of backwashing resulting from their removal.

The long-term success of any commercially available arsenic removal process and adsorptive product will result from continued research and development to ensure that process and implementation efforts are optimized.

Would you have any further questions, don't hesitate to contact us or our bellow address.

ECM ECO Monitoring, a.s.
Nevádzová 5
821 01 Bratislava

Tel.: +421-2-4342-9417
Fax: +421-2-4342-7465
www.ecomonitoring.com