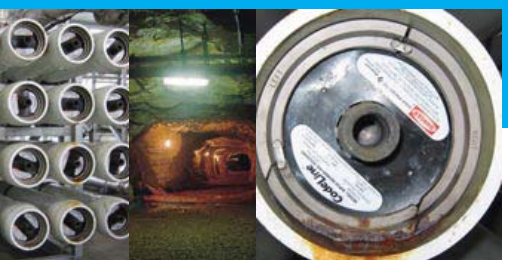
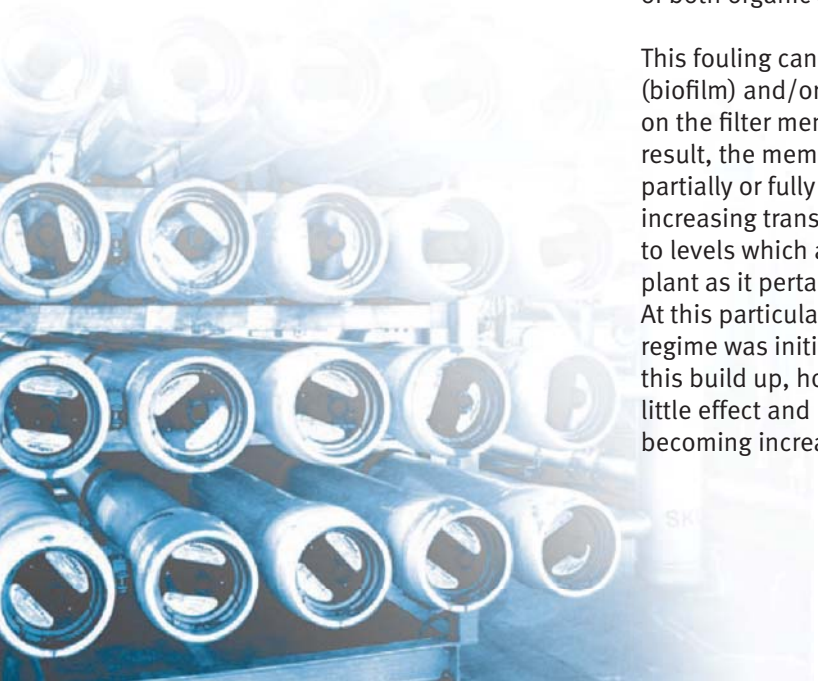


Case Study

Biofouling Of A Water Filtration Plant

Aeris Biological Systems' remediation of Pall Microza™ hollow fibre microfiltration units on a Worth Recycling Integrated Membrane System (IMS) which services a NSW based underground coal mine. The IMS consists of microfiltration and reverse osmosis steps. The remediation restored productivity and "flux" to the IMS ensuring a reliable supply of water to the mine's operation



Summary

In July 2007, Aeris Biological Systems ("Aeris"), a wholly owned subsidiary of ASX listed Aeris Technologies Ltd, assisted in a remediation of a Worth Recycling IMS unit attached to a NSW based underground coal mine.

The primary objectives of the treatment were to address and alleviate the existing cleaning regimes and high trans membrane pressures on the unit. These had been causing plant shutdowns and sub-optimal operating performance.

The Mine's Problem

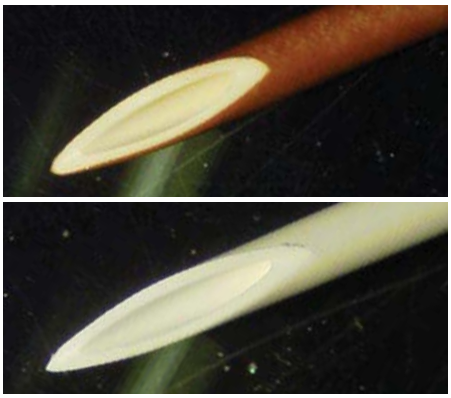
In their mode of operation, all filtration systems are subject to the integrity of the feed waters supplying the system. Underground coal mining operations require large amounts of "clean" water for both longwall dust suppression and fire-fighting supply. However, once returned, this water has a high degree of both organic and inorganic fouling.

This fouling can rapidly deposit organic (biofilm) and/or inorganic deposits on the filter membrane surfaces. As a result, the membrane pores become partially or fully occluded, thus increasing trans membrane pressures to levels which affect operation of the plant as it pertains to plant outputs. At this particular site, a daily cleaning regime was initiated to try to combat this build up, however this was having little effect and plant downtime was becoming increasingly significant.

Situation Identification

In investigating this problem, Aeris needed to determine the nature of the fouling of the circuit in order to develop a customised formulation solution using its patented AerisGuard Multi-Enzyme Biofilm Removal Technology. In addition, Aeris suspected that the problem was a combination of both biofouling and inorganic "scale" formation. Aeris obtained a sample of the filter which was cut open and the individual filter lumens were subjected to electron microscopy and other diagnostic tests.

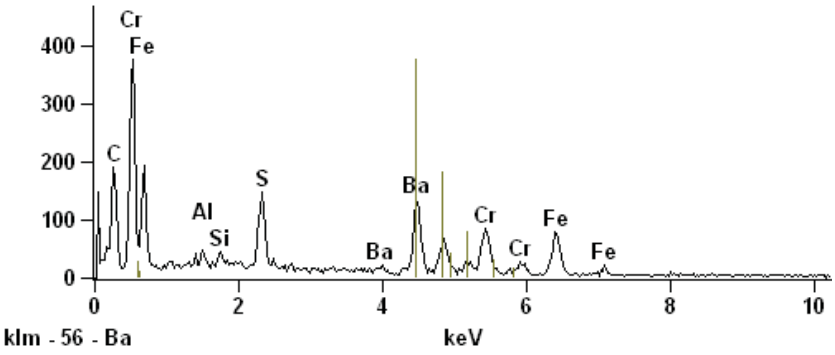
Filter Lumens Undergoing Testing



Top: Untreated Lumen
Bottom: AerisGuard Treated Lumen

From the detailed analysis conducted by Aeris, it was concluded that the fouling was a very stubborn combination of mineral salt deposits (barium, iron and carbon) interlaced with a biofilm deposition which is resistant to a traditional cleaning regime (see graph overleaf). As a result, multi-enzyme and stabilised acid trials were performed in the laboratory to determine a suitable multi-enzyme and descalent cleaning regime.

Graph Of Detailed Filter Analysis



Energy Dispersive X-Ray (Edx) Analysis Of A Surface On The Untreated Sample

Methodology

Aeris selected the suitable product mix and manufactured and transported it to the site. Aeris' unique and patented technology has the ability to not only combine and stabilise large numbers of different enzymes but can also modify these enzymes to allow efficacy in conditions such as low pH, relatively high levels of free halogens and temperature variation.

Due to the high degree of inorganic fouling evident on the membranes, a special stabilised acid was prepared for "in situ" dosing with specific multi-enzymatic formulation.

Results

Using the specifically formulated stabilised acid and patented Aeris multi-enzymatic solution, a CIP (Clean In Place) procedure was carried out. As a result, the Trans Membrane Pressures (TMPs) were immediately lowered, thereby addressing the most significant concern of the plant's productivity. This TMP was significantly lower than it had been historically, when traditional cleaning regimes had been used at the plant.

The thoroughness of the specialised Aeris remediation of the membrane ensured it retained its flux for longer than it had whilst being treated by traditional cleaning methods. This resulted in higher outputs (litres of water per hour), reduced cleaning time and reduced cost of traditional chemicals.

Benefits Of AerisGuard To Biofouled Water Filtration Systems

Productivity
An AerisGuard treatment of the water circuit, using the specific AerisGuard multi-enzymatic formulation in conjunction with the stabilised acid, results in lower trans membrane pressure values which in turn allows for higher and more consistent plant outputs. This is especially important as a significant percentage of IMS economics are directly linked to actual water volumes processed by the plant.

Reduction In Traditional Cleaning Chemical Cost And Frequency Of Application
Traditional cleaning strategies employed in IMS plants are effective in alleviating fouling of the plant. However, in severe cases, and especially where biofouling is present, the chemical-resistant nature of the biofouling can mean a significant increase in cleaning is required. This results in an increase in consumables, cost and plant equipment utilisation.

Membrane Economics
Over time, traditional chemical treatments can affect the efficacy of the filtration membranes. This in turn reduces the usable membrane life requiring renewal of the membrane. AerisGuard Multi-Enzyme Biofilm Removal Technology does not attack or interfere with membrane pore specificity, thereby ensuring maximum membrane lifespan.

Capital Cost Considerations
With the correct remediation regime it may be possible to achieve higher operation rates of flux (litres per meter of membrane surface area per hour). If this is factored in at the plant design stage then there could be significant savings in the form of lower capital costs.

The AerisGuard technology is based on 20 years of research and development into biofilm removal. It has been applied across numerous applications such as air conditioning and refrigeration systems, in global markets including USA, Europe, Asia and the Middle East.

aeris guard BIOLOGICAL SYSTEMS

Aeris Biological Systems - a division of Aeris Technologies
5 / 26-34 Dunning Avenue
Rosebery, NSW 2018
Tel: +61 2 8344 1315
Fax: +61 2 9697 0944
www.aeristechnologies.com