KWATYE PRIZE 2005

Colour Removal without Chemical Addition

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The Kwatye (Water) Prize sponsored by Environmental & Process Technologies (Division of Biolab), provides an opportunity for WIOA members to apply to investigate an area of interest that has the potential to benefit the water industry. As a WIOA member for many years I decided to apply for the prize to study an area of water treatment that is of particular interest to me, the area of membrane technology and in particular nanofiltration. So with considerable surprise I was awarded the prize at the Victorian Operators and Engineers Conference last month.

So what are my plans??

With the prize money, and considerable help from GWMWater I plan to visit a number of membrane plants in Europe, Scotland, Scandinavia and USA to study the application of nanofiltration. The field trip is scheduled to start in mid February with a return to Australia in late March.

Soft coloured water supplies usually require chemical treatment to convert the dissolved organic carbon (DOC) into a flocc so that it can then be removed. Low alkalinity waters require pH correction to ensure that coagulation and flocculation is optimised. However no matter how well the water is preconditioned and coagulated, a recalcitrant portion of the DOC will remain in the water. This remaining DOC is available to react with disinfectants to form DBPs, and can affect the taste and odour of the treated water directly or indirectly as a result of their interaction with chlorine.

GWMWater, like many water authorities, has undertaken extensive community consultation and the key message from our customers is that they want to reduce or eliminate the use of chemicals in the treatment of their water.

The advent of nanofiltration (NF) and ‘tight’ ultrafiltration (UF) membranes provides water authorities with a new set of tools to remove colour from soft water without the need to chemically treat the water, and at the same time provide superior water quality.

UF or NF membranes can significantly reduce the precursors to DBP production thereby reducing the disinfectant dose necessary to maintain a residual concentration to protect customers. Removal of DOC also serves to minimise the growth of biofilms in distribution networks by limiting the food available. Reduced biofilm growth equates to better water quality and a reduction in maintenance activities within the distribution system.

Membranes are able to remove bacteria, viruses and protozoa far more effectively than 'conventional' water treatment. This further reduces the risk of water borne disease transmission.

A further advantage of using membranes without chemicals is a reduction in the quantity of inorganic sludge generated by 'conventional' water treatment process. Inorganic sludge generally poses a disposal problem and if applied to soil it can lock up soil phosphorus and make it unavailable to plants so broad acre applications are severely limited. The concentrated organic material generated using membrane processes may have some potential as a soil conditioner thereby reversing the trend of disposal to that of beneficial reuse.

A number of membrane manufacturers including Hydranautics, Koch Membranes and Dow FilmTec have all developed membranes capable of removing dissolved organic carbon from raw water. The questions that require further study to determine what applications suit these membranes best include.

- What recovery rate is sustainable for UF and NF using different DOC sources such as that typically found in Tasmania, tropical north Queensland, the Northern Territory and the mountain regions of Victoria and NSW.
- Can NF and UF membrane system operate with recovery rates as high as 90%?
- Can increasing raw water temperature enhance DOC removal?
- What type of fouling problems will be generated and what cleaning procedures are required?
- Will these membranes be subject to increased microbial fouling because of the concentrated food source available?
- What are the limitations in water quality with respect to the types of DOC and alkalinity concentrations as well as calcium hardness?
- Can the concentrated DOC be used as a soil conditioner when the raw water supply is soft? Can this equally apply to hard coloured water sources?

Answers to the questions raised in this application are currently being sought from the membrane manufacturers in California. Site visits of operating UF and NF processes designed for colour removal are currently being arranged in Scotland, France, Norway and Florida. One particular process operating at Irvine Ranch in Orange County claims an operating recovery of 95% and extraordinary DOC removal.

Another large scale application provides treated water to over 800,000 people in northern Paris from the Méry-sur-Oise nanofiltration plant. Raw water is harvested from the Oise River that is described as polluted. The plant operations group has modified and developed a cleaning program that maintains membrane performance so it will be interesting to see the progress they have made.

The new UF plants installed to supply Mosman in far north Queensland have recently been commissioned and direct operating experienced should be available at this stage.

These sources should be able to provide specific operational knowledge and help develop this process in Australia.

The Kwatye Prize has provided me with a unique opportunity to investigate my area of interest and return some of this knowledge to the Australian water industry. You too could have this opportunity of a lifetime if you win the prize next year. So why not enter. You never know you just might win.

The Author

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