Reducing algae in freshwater feeds at waterworks

Evaluating the effectiveness of upstream automatic screen filters in reducing algae in freshwater feeds at waterworks

Fig. 1: Pilot unit at the pumping station in Kranji

Fig. 2: The Filtersafe strainer basket

Algal blooms in freshwater reservoirs can overload water treatment units, such as media filters and membrane filters, which typically form the pre-treatment processes at waterworks. This can lead to a reduction in the output of treated water and an increase in membrane fouling. Technologies to reduce algae from feed water before it reaches downstream water treatment units, such as dissolved air flotation, microfiltration (MF) and ultrafiltration (UF), exist but they increase system complexity and require the use of strainers to protect the polymeric fibres used in these processes from physical damage.

As such, PUB has been exploring the use of upstream automatic screen filters, or auto-strainers, as a pre-treatment. It is testing the Filtersafe, an auto-strainer manufactured by Kupps & Sachs with four sintered, stainless steel screen layers and a weave-wire mesh, at a pumping station in Kranji (Fig. 1 and Fig. 2). Filtersafe was selected as it boasts high sediment removal rates and has an automatic self-cleaning mechanism, thus allowing for continuous use.

“Preliminary projections show that such strainers could have advantages over other forms of pre-treatment in terms of removing algae from feed water more effectively,” PUB senior engineer Jason Wong said, adding that auto-strainers can enhance the reduction of algal loads on the MF/UF process if used as a first step, therefore reducing the fouling of membranes.

To evaluate the use of Filtersafe as a pre-treatment, the auto-strainers with screens of different mesh sizes were rigorously tested using freshwater drawn from Kranji Reservoir, upstream of the pumping station’s coarse screens. In self-cleaning basket strainers such as this one, a pressure difference between the inlet and outlet is created when the strainer gets clogged, triggering its backwash mechanism to remove suspended solids that accumulate on the screen’s inner surface. As such, no additional flushing pump was used during testing and the strainer filtered the feed water concurrently with the backwash step.

While using a 40-micron screen did not significantly affect the removal of chlorophyll-a (an indirect measurement of algae), chlorophyll levels in the filtrate fell when a 25-micron and 10-micron screen was used. In particular, the 25-micron screen had a removal rate of 10.6% to 54.6%, while the 10-micron screen had a removal rate of between 34.7% and 45.7%. However, the downside of using finer screens is that the system would have to be operated with a lower throughput, meaning less water can be filtered within the same period of time.

“We are evaluating what the next step should be and we are keeping our options open,” Wong said.

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