

INSIGHT

PHOSPHORUS REMOVAL

The percolating filter at East Meon WTW



Soneco boom



Amid the clamour for effective new means of phosphorus removal, Power & Water CEO Gareth Morgan discusses his company's Soneco system, which combines electrolysis with ultrasound for an eco-friendly solution



Phosphorus (P) is a natural but limited element that is used by all living organisms and is essential to food security due to its effect as a growth promoter. However, when levels of P are excessive, it overstimulates the growth of algae in our lakes and rivers and leads to a gradual depletion of oxygen, which can ultimately render the waterway lifeless (eutrophication).

Traditional sources of P (rock phosphate) are depleting. Sewage, including farmyard manures, is a rich and renewable source, but its re-use as a fertiliser is commonly the cause of excessive P-loads being released into our water courses, increasing the problems associated with water treatment.

These excess levels of P can be efficiently removed by adsorption, whereby contaminants are captured onto a 'surface'. Historically, metal salts in the form of liquid chemicals have been used but the disadvantages of this (H&S issues with transport, handling, storage, overdosing, need for clean water supply, etc) are legion, so new, more effective

treatment measures are constantly being sought in order to consistently achieve discharge targets.

KP2M Ltd, trading as Power & Water (P&W), has developed such a method using

electricity, whereby metal ions coagulate and flocculate to create three-dimensional metal hydroxide networks that adsorb colloids, fines, clays, metals and nutrients. The resultant floc particles are then

separated downstream in proprietary downstream solid-liquid separation processes. Ultrasound applied during electrolysis increases the number of nucleation sites to improve flocculation.

P&W's patented Soneco process is an economic and technically optimised alternative to liquid-chemical dosing. It combines electrolysis with ultrasound, ensuring safe and efficient water treatment by



The humus settlement tank



electro-generating pH-neutral reactive reagents (metal cations) and metering them directly into the process stream.

The efficacy of Soneco as a method of phosphorus removal is supported by Southern Water, which rigorously evaluated and validated the system over a 12-month period with UKWIR. It compared the Soneco ion electrodes with ferric salt dosing as part of the wider National Phosphorus Programme and concluded that it was the more environmentally friendly and cost-effective process.

Key conclusions of this extended study highlight that Soneco efficiently and reliably treated the provided flow rate of 3.6m³hr⁻¹ to achieve consistent Total P removal to levels below 0.5mg/l and achieved Ortho P as low as 0.03 mg/l in the treated effluent during the trial.

This means that Soneco achieved invariable P removal rates of 98 per cent (Total P) and 99.7 per cent (Soluble Reactive P). The resultant effluent forms a highly de-watered ferric sludge that can also be recirculated to the head of the works, adding to the treatment potential and providing a “double treatment” from the single process. The process also maintained an effluent with an iron concentration below 4mg/l discharge content and can be optimised to remain below 3.2mg/l.

Ultrasound improves treatment efficiency through the generation of oxidative radicals and by the increase in nucleation sites, ensuring better coagulation and flocculation. It also acts as a cleaning-in-place (CIP) tool for the electrodes, keeping the surfaces clean by cavitation, thereby maintaining an evenly reactive treatment surface.

Soneco has been proven to be a highly cost-effective method of P removal, especially at smaller works and those where alkalinity dosing is required. The system is eco-friendly and, in comparison with other methods, has a greatly reduced environmental impact and improved carbon footprint. With a small physical footprint, Soneco is easily integrated or retro-fitted to existing over-loaded or under-performing works, and sludge volumes are as much as 50 per cent lower than with other methods.

Following Southern Water's successful validation of Soneco for P removal and progressing until AMP7, P&W and

Southern Water are now working on the fully engineered solution to accommodate the full-flow treatment and P-loading of small and medium sized works.

As Southern Water's report said: “Based on consistent removal of total and soluble reactive phosphate within the treated effluent, the results are excellent for a single stage iron dosing process followed by conventional humus settlement.”

The positive results and further benefits of the technology highlighted by the Southern Water trial have not gone unnoticed; other utility companies have already shown great interest in Soneco, their aim being to further utilise the technology for P removal and sludge enrichment.

When P&W sought customer feedback from Southern Water upon completion of the trial, Cecile Stanford, process capacity engineer integrated planning, said: “It was a pleasure to work with this innovative company. Results have been consistent and reliable with a definite potential on small wastewater sites where the ideal solution for P removal has not yet been found. This process certainly provides an answer to be considered and P&W have been very receptive to our demand.”

The joint UKWIR-funded initiative has seen Power & Water and Southern Water named as finalists of the Water Industry Achievement Awards in the “Most Innovative Use of an Existing Technology” category.

We believe Soneco has the potential to create a paradigm-shift in P removal processes and wastewater treatment technology. We intend to use this potential to also focus on the delivery of clean water treatment and sludge enrichment solutions which sees Soneco used with magnesium electrodes to recover P and treated water for re-use or discharge as well as creating a potentially high-grade struvite fertiliser (magnesium ammonium phosphate, or MAP) that can then either be re-used or sold and help to reduce reliance on raw materials within the supply chain.

Going forward, P&W look forward to continuing our collaborative work with Southern Water and see Soneco making an important and monuments contribution to the National Environmental Programme (NEP) during the remainder of AMP6, into AMP7 and beyond.

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