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BIV202004

Engineering and Physical Sciences Research Council
Biotechnology and Biological Sciences Research Council

Meeting the nutrient neutrality challenge using newly-developed biological technology

"The BIV project has provided an invaluable opportunity to work closely with an academic partner in both progressing our understanding and optimising performance of our unique BNR technology". Adam White, Plantwork Systems Ltd

AIM

To protect our water bodies from eutrophication, nutrient discharge limits are being tightened. This has significant impacts on the water industry as well as the environment, as most existing nutrient removal technologies are expensive to install and require significant amounts of energy and chemicals. This results in pollution levels being reduced in the receiving water bodies, but increased in the air and soil due to the technology having a larger carbon footprint and producing more chemical-enriched sludge for disposal. There is thus a major requirement in the wastewater treatment market for a more sustainable nutrient removal technology which uses less energy and no chemicals.

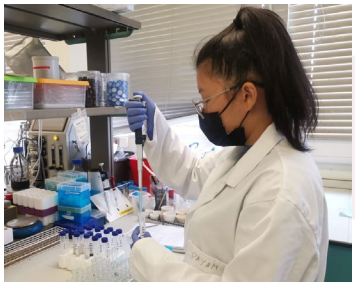
Plantwork Systems Ltd (PWS) has designed, built and operated a prototype biological nutrient removal plant branded as NUTREM®. PWS will work in partnership with the University of Southampton (UoS) to optimise the process to achieve very low concentrations of total Nitrogen (TN) and total Phosphorus (TP) in the final treated effluent, i.e. less than 5 mg/L TN and less than 0.5 mg/L TP.

RESULTS

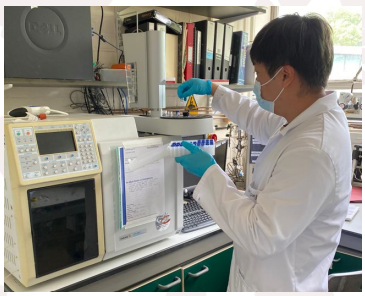
Meeting nutrient neutrality is a pressing challenge particularly in the south of England after Natural England started to require nutrient neutrality from the year 2020. NUTREM® was originally developed by PWS to provide a viable biological nutrient removal technology suitable for use in the UK.

In this project two reactors, each with a working volume of 47 m^3, were operated at the NUTREM® demonstration plant in the full-scale operational treatment facility at Petersfield STW in Hampshire.

Samples from each reactor and from other points such as the influent and fermenter were taken and analysed weekly. Two complete process cycle analyses were carried out, across two distinct cyclic configurations. After optimisation, the nitrogen concentration was reduced from 13-31 to 5-11 mg/L TN while phosphorus remained as low as 0.04-0.28 mg/L TP without any addition of chemicals or additional filtration unit. The results demonstrate that the NUTREM® plant has great potential to achieve nutrient neutrality cost-effectively and sustainably.



"This BIV project provided an excellent opportunity to demonstrate how the collaboration between academics and industry partners allows a combination of strengths from both parties to support practical applications with fundamental research".
Dr Yongqiang Liu, University of Southampton



Hydroxyapatite precipitation and accumulation in granules and its effects on activity and stability of partial nitrifying granules at moderate and high temperatures Liu, Y.Q. and Cinquepalmi, S., 2021. Processes, 9(10), p.1710.