

NEW AUSTRALIAN PYROLYSIS TECHNOLOGY DELIVERS BREAKTHROUGH IN BIOSOLID TO BIOCHAR CONVERSION

Biosolids conversion is fast becoming an integral part of the circular economy. In partnership with Intelligent Water Networks (IWN) and Greater Western Water, South East Water and its commercial arm Iota have proved the effectiveness of PYROCO, a breakthrough pyrolysis technology developed by RMIT University that converts biosolid to biochar while eliminating PFAS.

Armed with solutions such as PYROCO, water authorities have an opportunity to drive the shift to a circular economy.

WASTEWATER SLUDGE CREATES ENVIRONMENTAL AND OPERATIONAL CHALLENGE

Growing populations are driving water utilities to produce increasing volumes of wastewater sludge. The worldwide production of biosolids is estimated to be in the range of 100 to 125 million tonnes and is expected to increase. Australia alone produces over 300,000 tonnes of dry solids each year. Currently, around 30 per cent of global biosolids resources are stockpiled or sent to landfill, creating a huge environmental challenge.

Globally, water authorities' options for managing wastewater by-products are increasingly limited.

"Most treatment facilities manage sludge waste through drying, stockpiling and transporting for spreading on land. A deeper understanding of the impact of microcontaminants on the environment is driving water authorities to seek alternatives. They are increasingly conscious of the environmental implications of perfluoroalkyl and polyfluoroalkyl substances, microplastics and other emerging contaminants," Eamon Casey, Technical Director at Iota, said.

In previous years, South East Water has distributed up to 6,000 tons of dewatered treated biosolids. Diminishing landfill options and the environmental impact of microcontaminants led South East Water to develop a sustainable solution for disposing of wastewater sludge.

"The disposal of biosolids is a challenge across the water industry. South East Water is continually looking for ways we can work with others to create innovative solutions to protect our environment and help our customers and community," Lara Olsen, Managing Director at South East Water, said.

PYROCO REACTOR DELIVERS A SCALABLE, SUSTAINABLE AND ENERGY EFFICIENT SOLUTION

RMIT has worked with South East Water over the last five years to develop a more sustainable pyrolysis technology based on patents developed by RMIT. The highly efficient PYROCO reactor destroys 100 per cent of contaminants using low energy requirements.

In the pyrolysis process, gases and biosolids converge on a fluidised bed at approximately 600 degrees Celsius to efficiently convert organic biosolids into high quality biochar.

The pyrolysis gases and oils produced in PYROCO are converted into thermal energy to sustain the high temperature process. The elevated temperatures make it possible to

convert biosolids to high quality biochar. The fluidised bed ensures consistent heat transfer, as well as high product quality at lower emissions than alternative approaches. During the conversion process, PYROCO removes contaminants such as PFAS, residual pharmaceuticals, and pesticides.

POWERFUL SOURCE OF ENERGY

As utilities seek to achieve climate neutral footprints, the process sequesters carbon, making it possible for water utilities to become carbon negative and achieve carbon offsets.

"We can produce enough heat to dry incoming biosolids for a thermal energy neutral plant," Mr Casey said.

"This emerging thermal technology space is new for the water industry. The next generation of operational engineers will need training in new techniques and methodologies," Aravind Surapaneni, Senior Research Scientist at South East Water, said.

"Biochar is the next important development for the global water industry."

PORTABLE PLANT WITH A SMALL FOOTPRINT

Amongst its game changing differentiators is PYROCO's ability to convert organic material efficiently and sustainably into high-quality biochar within a scalable and portable plant structure. Built for all water authorities, the PYROCO plant fits into a modular and portable structure that can scale for future commercial needs. Its small footprint is a great fit for regional water authorities managing smaller-scale stockpiles.

"This scalable technology is a key benefit of the solution for urban and regional water utilities," Ms Olsen said.

WATER UTILITIES, THE AGRICULTURE SECTOR AND INDUSTRY TO BENEFIT

The reactor converts waste products into a high-quality biochar. "The biochar we are creating through pyrolysis has an incredible pore structure. It has the capacity to hold materials within the structure," David Bergmann, Research and Development Manager at South East Water, said.

Repurposed for agriculture

Due to its high-grade qualities, as well as its bioavailable and slow-release nitrogen and phosphorus nutrients, PYROCO biochar is particularly beneficial for farmers seeking to enrich nutrient-deficient farmland, and to optimise soil health.

Opportunities for infrastructure and construction

PYROCO biochar can be repurposed as a binding agent in road pavements and can work as a cement replacement. Its porous structure also serves as a more cost-effective and sustainable filler for building structures. Additionally, PYROCO biochar can be used as a polishing filter for contaminated discharges due to its excellent absorption traits.

New environment-friendly battery

In future, the carbon formed biochar has the potential to be repurposed for producing sodium-ion batteries, offering better environmental credentials than mainstream lithium-ion batteries.



NEXT STEPS

South East Water has commissioned a large-scale PYROCO demonstration plant to process up to 3,000 tonnes of dewatered biosolids a year and produce approximately 650 tonnes of biochar. The plant is expected to be operational in mid-2024.

"Overall, the business case for conversion of biosolids to biochar using the PYROCO solution is positive on every assessment measure which includes NPV, Net Zero Impact, PFAS destruction and Risk Mitigation," Mr Casey said. **U**

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