WATER SERVICES ASSOCIATION OF AUSTRALIA

Biochar 2 Batteries

Biochar can replace graphite in batteries for economic and environmental benefits

KEY FINDINGS

- Biochar from biosolids can be used as the anode material in Na-ion batteries.
- The quality of the biochar is important to enhance battery performance.
- There is economic potential & environmental benefit for the Australian water-sector to produce and sell biochar for use in batteries.

SUMMARY

Biochar 2 Batteries is an applied research project assessing the feasibility of using biochar made from different ratios of residential food and garden organic waste and biosolids in energy storage devices such as Sodium Ion Batteries (Na-ion) and super-capacitors. While the immediate aim is to test the technical feasibility, the bigger ambition is to unlock higher-value commercial applications for the Australian water-sector within the context of rapidly expanding opportunities across the CircularEconomy.

Using biochar in Na-ion batteries can help reduce the use of graphite, commonly used in Lithium-Ion Batteries. Graphite is considered a critical mineral and is fossil-fuel intensive when mined or processed synthetically from by-products such as petroleum coke. There are also supplychain constraints and point-of-failure risks(for example, more than 90% of global raw graphite is processed in China). Current market estimates for graphite range between $8,000 - $20,000 per tonne, underscoring the potential commercial incentive of this project. Na-ion batteries, in contrast to Lithium ion, prefer 'hard carbons' (such as those found in bio-chars) due their inherent disorder allowing sodium to be intercalated.

Biochar 2 Batteries envisions the water-sector as a leading participant in developing next-generation battery materials, unlocking market potential, enhancing the circular economy by using a sustainable by-product from wastewater treatment, and stimulating partnerships across industry, academia, and government.

RMIT's ARC Biosolids Transformation Centre Deputy Director Professor Kalpit Shah were responsible for co-pyrolysizing multiplefeedstocks (food, garden, and biosolids) to produce a carbon-rich biochar. The biochar was produced using RMITs patented PYROCO technology, a fluidized bed heat exchanger that significantly improves heat and mass transfer, and at lower cost. RMIT research revealed that carbon nanomaterial coated biochar can significantly improve carbon content and battery and super-capacitor performance. They also found that the biochar quality is important, particularly removing any impurities (such as silica) that can occur during feedstock harvesting. Deakin University Battery and Innovation, led by Professor Maria Forsyth, tested biocharin Na-ion batteries. One of the 'biosolids derived biochars' performed very similar to current commercial anode material, validating its feasibility and demonstrating the potential.

Biochar 2 Batteries is a collaboration between leading research institutes RMIT and Deakin University togetherwith Victorian water utilities Barwon Water and South East Water, as well as the Intelligent Water Networks, Department of Energy, Environment and Climate Action (DEECA), and The City of Greater Geelong.

Project Value: $240,000
Cash: $150,000
In-Kind: $90,000

- Partners:
- DEECA
- Barwon Water
- South East Water
- Intelligent Water Networks (IWN)
- The City of Greater Geelong

Value: A world-first project that uses biochar from biosolids to power Na-ion batteries. Unlocking economic potential for the water-sector and expanding an advanced Circular Economy.

MORE INFORMATION www.wsaa.asn.au

RMIT UNIVERSITY Barwon Water DEAKIN UNIVERSITY GEELONG