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Anaerobic digestion is a form of wastewater treatment, which is increasingly important as urbanisation and industrial development increase production of wastewater. In addition to addressing waste, anaerobic digestion is a renewable energy technology, as it produces biogas, primarily methane, which is a renewable energy source. Climate change is increasing pressures to improve renewable energy technologies to replace fossil fuels. Anaerobic digestion research is important for the technology to keep up with other renewables.

Foaming, which refers to trapped air bubbles stabilised by molecules in the sludge, is the most common operational issue of anerobic digesters, as it can reduce biogas production, disrupt mixing and cause various safety issues because of overflowing. This not only negatively impacts the efficiency of anaerobic digesters, but also increases cost of operation of biogas plants through cleanup, increased maintenance and reduced biogas production.

The mechanism of foaming is not well understood, however, understanding the microbial community's ecology and functions is essential as they are at the core of how anaerobic digestion transforms waste into renewable energy. An important mechanism of microbes to interact with their environment is the production of extracellular polymeric substances (EPS). EPS are a broad category of substances that are produced by microbes in the sludge which can have various functions and they have been linked to foaming in the past.

In order to observe the ecology within the digesters, Oxford Nanopore sequencing will be employed to analyse metagenomic samples from foaming sludge from lab scale digesters. This will provide insight into the community's composition and functional potential. The objective of this research is to investigate the role of EPS in anaerobic digestion foaming. It aims to identify EPS producing organisms and EPS production gene pathways in foaming anerobic digestion sludge.

This research will contribute to the understanding of foaming mechanisms, which is necessary for developing methods for management and prediction of foaming events. It is expected to be completed by 2025. Biogas plant operators will be able to utilise the results of this research to develop strategies to prevent foaming, avoiding growth of identified organisms or upregulation of identified pathways by changing their operational parameters or feed sludge.

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