



## *FishRefine* - Development of a bio-refinery system for organic acid production, bioenergy generation and nutrient recovery using fish wastes from Tumaco, Colombia

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<b>Related website</b>	<a href="https://www.britishcouncil.org/education/science/institutional-links">https://www.britishcouncil.org/education/science/institutional-links</a>

Tumaco, Colombia is the second largest city on the Colombian pacific coast. It has a large fishing industry, which produces 700 tonnes of fish waste per year. In the fish filleting industry, fish waste accounts for 50-60% of the fish mass input and does not add any value to the industry. This fish waste represents a significant organic waste stream that is also present worldwide. Fish waste has potential as a feedstock for high value chemical production through anaerobic fermentation to volatile fatty acids (VFA) and biogas.

One of the major challenges with fish waste processing is the high nitrogen content. During the process nitrogen is released as ammonia, which acts as a pH buffer complementing acid production, but also has an inhibitory effect on the microbial community. Without the ammonia present the VFA concentrations would also inhibit the microorganisms. Therefore, this project looks at developing anaerobic fermentation of fish waste with integrated product recovery of ammonia and VFA. This creates two main product streams: VFAs to be sold as renewable chemicals and ammonia. Any unfermented fish waste can then be further processed by anaerobic digestion for biogas production. This process development will begin to align anaerobic digestion with the field of biorefining.

This project is joint with Universidad Nacional de Colombia at Palmira and Swansea University. The work at the University of Southampton focuses on the product recovery aspect of this project. This involves developing and optimising a membrane extraction method to selectively recover VFAs and ammonia from the anaerobic fermentation broth. Where the fermentation broth is passed across one side of a membrane, with an extractant flowing on the opposite side, the VFA/ammonia will selectively transfer across the membrane into the extractant. This will reduce any inhibition of the microbial community by VFA and ammonia, and creates new product streams from fish waste processing.

### Objectives

- Assess and optimise the anaerobic fermentation of fish waste for selective VFA

production

- Develop and optimise a membrane extractant process for selective recovery of VFA and ammonia from fermentation broth
- Evaluate biogas production from fish waste and its fermentation residue via anaerobic digestion
- Integrate the different components of the proposed biorefinery and carry out preliminary evaluation of its carbon and energy balance in context of Tumaco practice
- Establish a basis for continuous development of anaerobic biotechnology for organic wastes management in Colombia

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