SNAPSHOT

AUSTRALIAN MEAT PROCESSOR CORPORATION

Purple phototrophic bacteria for resource recovery from red meat processing wastewater.

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Project Description

Australian red meat processing facilities generate large volumes of waste and wastewater that require treatment to remove nutrients and organic contaminants in order to comply with water discharge regulations. Effective treatment typically requires multiple treatment stages that can increase both cost and treatment footprint. Purple phototrophic bacteria (PPB) are an emerging technology that enables simultaneous, non-destructive capture of organics, nitrogen and phosphorous from wastewater streams as a protein rich microbial product. This project assessed the basic feasibility of PPB for the treatment of red meat processing wastewater.

Project Outcome

The project demonstrated PPB technology for red meat processing wastewater treatment is a new and potentially disruptive technology for generation of value-add products that could substantially change the economics of wastewater treatment. Major findings are:

- Combined wastewater entering primary treatment (such as dissolved air floatation) can be treated using PPB achieving 92% NH_4-N capture and 25% PO_4-P capture whereby TN and TP are persevered in the biomass. The portion of COD converted to protein biomass is still being assessed and optimised.
- When combined wastewater was pre-filtered to remove particulates, PPB treatment resulted in 74% Soluble organics, 64% NH_4-N and 73% PO_4-P being captured as a value added microbial protein, with scope for further optimisation.
- The PPB biomass product had a crude protein content above 60%, confirming potential to generate a value-add product, with a potential product value exceeding \$400-600 t^{-1}.
- Where the protein market is not yet developed, PPB biomass can be anaerobically digested to generate renewable biogas energy. Methane yields are higher than existing sludge treatment processes, however revenues are lower and this option creates a requirement for secondary effluent treatment.

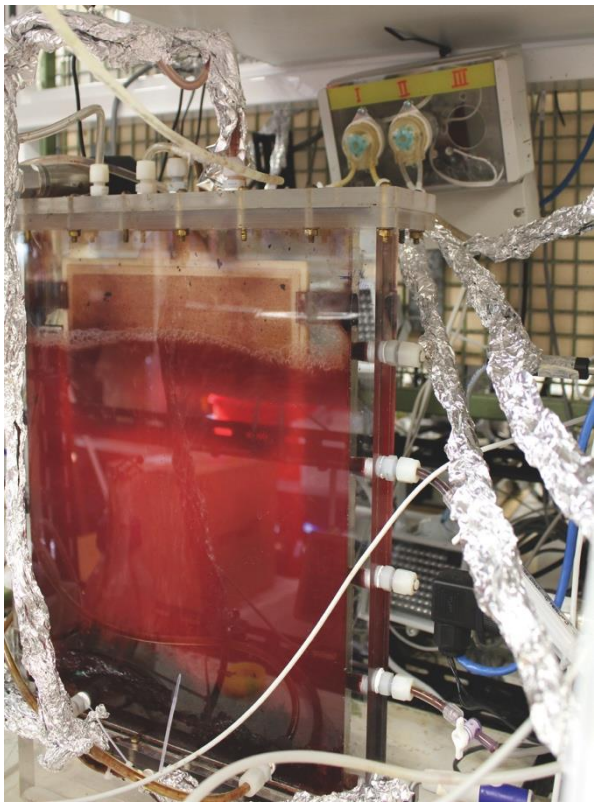

Figure: Photo Membrane Bioreactor generating PPB

Benefit for Industry

Preliminary cost comparisons of the PPB process (using a novel photo anaerobic membrane bioreactor (PAnMBR)) and alternative technologies treatment of red meat processing wastewater are shown in the Table below. The comparisons give an indication of the relative contributions of the organic removal and nitrogen removal steps for different technologies. Due to the novelty of the PPB process the capital costs of the reactor can only be estimated.

Parameter	CAL + BNR	CAL + anammox	AnMBR + anammox	PPB ($600 tonne^{-1})	PPB + AD +nutrient removal	CAL +PPB (with bypass)
Organic Removal	$1,858,000	$2,303,000	$5,816,441	$4,109,307	$11,049,947	$1,658,000
Nitrogen Removal	$3,289,000	$549,000	$607,000		$642,00	$4,082,000
Total Capital	**$5,147,000**	**$2,852,000**	**$6,423,00**	**$4,109,000**	**$11,692,00**	**$5,741,000/ $4,109,000***
Organic Operating	-$577,000	-$725,000	-$805,000	-$1,245,600	-$542,000	-$522,000
Nitrogen Removal Operating	$132,000	$51,000	$48,000		$107,000	-$830,400
Total Operating	**-$445,000**	**-$674,000**	**-$757,000**	**-$1,245,600**	**-$435,000**	**-$1,352,400**
Payback (years)	**11.6**	**4.2**	**8.5**	**3.5**	**26.9**	**4.2/3.0***

* no infrastructure present/ presence of CAL and Cogeneration. And ($400 tonne^{-1}).

As an emerging concept, the economics of the PPB technology require further research and the potential value and market for the microbial protein product requires validation. However, the initial feasibility analysis showed, that based on the best available information, capital costs of a PPB process are not excessive and are comparable to existing technologies and potentially less expensive than conventional biological nutrient removal technologies.

This project has confirmed high protein (>60%) and energy content of the PPB biomass generated during red meat processing wastewater treatment (>20MJ kgVSS^{-1}) which increases the potential value and makes application as feed or feed additive appear attractive. PPB biomass characteristics compare well with conventional feed/feed additives; however livestock feed trials are an important next step with trials on pigs and fish being planned through broader collaborative projects.

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