PO042

EXPLORING THE DIVERSITY OF ANAEROBIC SLUDGE TOWARDS GLYCEROL VALORIZATION

Magalhães, Carla Pereira[1,2]; Duber, Anna[3]; Stams, Alfons J. M.[2,4,5]; Alves, M. Madalena[1,2]; Cavaleiro, Ana Júlia[1,2]

1 - CEB - Centre of Biological Engineering, University of Minho, 4710-057 Braga, Portugal; 2 - LABBELS –Associate Laboratory, Braga, Guimarães, Portugal; 3 - Institute of Environmental Engineering, Poznan University of Technology; 4 - Centre of Biological Engineering, University of Minho, Braga, Portugal; 5 - Laboratory of Microbiology, Wageningen University & Research, Wageningen, The Netherlands

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The large amounts of glycerol produced by the biodiesel industry (10 % of the total biodiesel production) can create environmental and economic losses if sustainable strategies are not applied to utilize the surplus of this compound. The production of valuable chemical compounds by anaerobic microorganisms can be a sustainable treatment strategy to add value to waste-glycerol and to the biodiesel industry.
The objective of this work was to study the diversity and physiology of anaerobic microorganisms involved in glycerol consumption and valorization. Mesophilic enrichments were developed under sulfate-reducing and methanogenic conditions, using as inoculum anaerobic granular sludge from a brewery wastewater treatment plant.
After several transfers, three different stable cultures were obtained, with the capacity to grow with glycerol under different culture conditions. One enrichment, ferments glycerol mainly to propionate, with a yield of 0.88 mM propionate per mM glycerol consumed. This culture is dominated by a bacterium closely affiliated with *Propionivibrio pelophilus* strain asp 66, 98.5% ID based on 16S rRNA genes. The *P. pelophilus* strain asp 66 was reported to be unable to grow with glycerol. A second enriched culture was obtained which is constituted of *Desulfovibrio alcoholivorans*, 99.5% ID, and the methanogen *Methanofollis liminatans* strain GKZOZ, 98.8% ID. Incubations with 2-bromoethanesulfonate confirmed that this is a syntrophic co-culture. *Desulfovibrio alcoholivorans* converts the glycerol to acetate and H_2 and the methanogenic partner consumes the H_2, making glycerol degradation thermodynamically viable. In the third enriched culture, *Desulfovibrio sulfodismutans* strain ThAcO1, 97.5 % ID, reduces glycerol to acetate, but only in the presence of sulfate or a methanogenic partner.
In conclusion, starting from the same inoculum (anaerobic sludge), glycerol could be metabolized through different pathways by the enrichment cultures obtained. Fermentative, syntrophic and sulfate-reducing cultures were enriched forming valuable products that can be used in industrial applications or as energy carriers. Thus, anaerobic microbial communities are an asset to surpass the bottleneck of biodiesel production caused by the surplus of glycerol, allowing it to be sustainably treated and valorized.