"The Red Gold" that will fuel the Arctic

A. R. Pizarro, L. Garcia, and G. Vasilaki

Center for Arktisk Teknologi, Department of Civil Engineering

INTRODUCTION

In Sisimiut, Greenland, is located one of the world's largest shrimp industries. The factory is the main source of people's livelihood in the municipality and the shrimp trading contributes to approximately 50% of the total income in Greenland. Sisimiut plant receives 20,000 tons of shrimps per year; however, only 1/3 of this amount is edible. The rest (shrimp shells and tails) is discharged into the sea, threatening the fragile arctic marine environment. Several treatment options have been introduced in the past, which were proved disadvantageous, both economically and environmentally. This project focuses on the feasibility of biogas production from the shrimp by-products, an unexploited valuable resource, as an alternative solution.

THEORY

Biogas is produced during the anaerobic degradation of organic matter by different types of microorganisms. It consist mainly on methane and CO_2 and it can be used as a fuel for heating and electricity generation or it can be refined to natural gas standard and used in the same way. Biogas is considered as a renewable energy carrier that can replace fossil fuels and subsequently, reduce global warming.

METHODS

Experimental measurements have been made in order to identify the biogas potential of the shrimp by-products. The procedure involves mesophilic (37 ^{o}C) anaerobic digestion in batch-type reactors. Afterwards, the results were evaluated with a feasibility analysis facility in order to identify the economic viability of the project. In addition, a Life Cycle Assessment was performed to state the environmental impacts.

RESULTS

Methane yield of the shrimp by-products was estimated at approximately 400 ml CH_4/gr of organic matter, which was above the average biogas production of different substrates that are used in commercial plants in Denmark.

The shrimp industry in Sisimiut requires high amount of heat, which corresponds to more than the half operational costs. Thus, the biogas was planned to cover the heat demand of the factory that currently uses light oil.

The economic evaluation of the project demonstrated a positive Net Present Value and an Internal Rate of Return of 14%, which exceeds the usual preferences of the investors. The estimated biogas production was predicted to replace 63% of light oil consumption in the factory and decrease approximately 35% of the total operational costs.

Finally, the LCA showed that a great amount of CO_2 emissions can be avoided from fossil fuel substitution and the shrimp by-product handling can minimize the risk of marine pollution.