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審査研究科	生命環境科学研究科		
学位論文題目	Analysis of Economically and Environmentally Feasible Treatment for Giant Squid (<i>Dosidicus gigas</i>) Waste in Chile (チリにおける巨大イカ (アメリカオオアカイカ) 廃棄物の経済的及び環境的に実現可能な処理手法の分析)		
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論 文 の 要 旨

This Doctoral research aimed to find a sustainable solution for the treatment of giant squid waste in Chile which currently is being thrown into the ocean or disposed in the dumping sites located in the outskirts of the cities. Since artisanal fishing accounts for 80% of the all the squid catch in the country the problem is more difficult to address. As the current options are illegal and cause health and environmental problems the research explored energy recovery and valorization strategies. The study coupled the treatment options with the use of GIS suitability and network analysis. This tool helps us minimize the collection and transportation costs that have by far the highest financial burden in any waste management system.

Chapter 1 outlines the current situation regarding giant squid. The author highlights that the growing demand for squid has increased fishing activities, which in turn has also increased the amount of waste generated.

Chapter 2 provides and consolidates the information found in literature about squid waste treatments and its byproducts. The author explores the potential uses of squid waste i.e. by using the waste as a whole or focusing only on specific parts of the waste, such as skin or pen, among others, to extract and take advantage of the properties of specific compounds. The study identified that squid waste is rich in omega 3 oils, proteins, amino acids and other components that have several potential. However most of these component still need further studies to be finally introduced into the market.

Chapter 3 selects and studies further the extraction process of only those byproducts that are commercialized. It complements treatment efficiencies with information from laboratory results to compare and identify the most optimal treatment, or combination of treatments, in terms of monetary benefits and GHG emission savings.

Chapter 4 explores the potential of energy recovery from squid waste through anaerobic digestion and co-digestion with vegetable residues from vegetable markets. The study found that the best methane yield was obtained using only squid as substrate. The results of the laboratory analysis also found that the CH₄ production yield was considerable lower than other organic residues due to lack of fermentative bacteria in the samples to generate an adequate anaerobic digestion.

Chapter 5 uses GIS suitability analysis and network Analysis to identify the optimal location of a squid waste treatment plant in order to reduce the transportation cost while considering all the waste generating points, geographic restrictions and the land use regulation for this waste treatment plants.

In Chapter 6 the author concluded that anaerobic digestion of squid waste can be complemented with Chitin extraction, making it a two treatment scenario. This can complement the energy savings with potential economic benefits from the treatment of squid waste.

審 査 の 要 旨

This study explored feasible treatment options for squid waste in Chile where 80% of the national catch is assigned to artisanal fisherman. The study initially found that the production of fertilizer, combined with the production of chitin and melanin, showed the highest potential in terms of feasibility and environmentally friendly squid waste treatment. Since the government wants to increase the electricity generation from non-conventional renewal sources, this study also explored the potential of squid waste as biomass for anaerobic digestion with methane recovery. Results of the laboratory analysis found that the highest methane production was obtained using only squid as substrate. The methane contain in the biogas was low compared to other organic residues. Finally the study identified the optimal locations for the installation of fertilizing and biogas plants in each of the regions by using GIS suitability and networking analysis.

The final examination committee conducted a meeting as a final examination on 29 January, 2019. The applicant provided an overview of the dissertation, addressed questions and comments raised during Q & A session. All of the committee members reached a final decision that the applicant has passed the final examination.

Therefore, the final examination committee approved that the applicant is qualified to be awarded the degree of Doctor of Philosophy in Environmental Studies.