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Fishing Waste: A Source of Valuable Products through Anaerobic Treatments

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Abstract : Fish is one of the most commercialized foods worldwide. However, this industry only takes advantage of about 55% of the product's weight, the rest is converted into waste, which is mainly composed of viscera, gills, scales and spines. Consequently, if these wastes are not used or disposed of properly, they cause serious environmental impacts. This is the case of Tumaco (Colombia), the second largest producer of marine fisheries on the Colombian Pacific coast, where artisanal fishermen process more than 50% of the commercialized volume. There, fishing waste is disposed primarily in the ocean, causing negative impacts on the environment and society. Therefore, in the present research, a proposal was made to take advantage of fishing waste through anaerobic treatments, through which it is possible to obtain products with high added value from organic waste. The research was carried out in four stages. First, the production of volatile fatty acids (VFA) in semi-continuous 4L reactors was studied, evaluating three hydraulic retention times (HRT) (10, 7 and 5 days) with four organic loading rates (OLR) (16, 14, 12 and 10 gVS/L/day), the experiment was carried out for 150 days. Subsequently, biogas production was evaluated from the solid digestate generated in the VFA production reactors, initially evaluating the biochemical methane potential (BMP) of 4 total solid concentrations (1, 2, 4 and 6% TS), for 40 days and then, with the optimum TS concentration (2 gVS/L/day), 2 HRT (15 and 20 days) in semi-continuous reactors, were evaluated for 100 days. Finally, the integration of the processes was carried out with the best conditions found, a first phase of VFA production from fishing waste and a second phase of biogas production from unrecovered VFAs and unprocessed material Additionally, an VFA membrane extraction system was included. In the first phase, a liquid digestate with a concentration and VFA production yield of 59.04 gVFA/L and 0.527 gVFA/gVS, respectively, was obtained, with the best condition found (HRT:7 days and OLR: 16 gVS/L/día), where acetic acid and isobutyric acid were the predominant acids. In the second phase of biogas production, a BMP of 0.349 Nm3CH4/KgVS was reached, and it was found as best HRT 20 days. In the integration, the isovaleric, butyric and isobutyric acid were the VFA with the highest percentage of extraction, additionally a 106.67% increase in biogas production was achieved. This research shows that anaerobic treatments are a promising technology for an environmentally safe management of fishing waste and presents the basis of a possible biorefinery.

Keywords : biogas production, fishing waste, VFA membrane extraction, VFA production
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