Abstract

Dairy industry discharges sludge contains a high concentration of organic compounds and suitable for the production of various kinds of value. The optimisation and process improvement on individual processes of a sludge treatment can indeed reduce the waste treatment cost, and subsequently, improve the profit of the dairy industry. Yet by efficiently utilising the sludge to produce value-added products, the dairy industry can potentially gain extra profit. Thus, there is a need to develop a framework to screen and synthesise the optimal process pathways for the sludge from the dairy industry. This work presents a Mixed Integer Non-Linear Programming (MINLP) model to obtain the optimal utilisation and selection of the processing route for dairy industry sludge subject to maximise the profitability of value-added product, by considering the revenue of value added product, total processing costs and capital cost of thickening, dewatering and processing technology, and the transportation cost of dewatered sludge to by-product processing industry. The difference between the new optimal route and the baseline case study were highlighted with the impacts of the economic performance on the fluctuation of the mixed sludge volume. The result of optimisation model shows that the maximum profit can be achieved is 31,789 MYR/month while the total variable cost can be reduced from 185,800 MYR/month to 87,407 MYR/month which is reduced by 52.96% as compared to the baseline case. Vermicomposting was found to be the optimal choice of processing technologies due to the high profitability.