STUDY OF RECOVERY POTENTIAL OF VALUE-ADDED BY PRODUCTS IN PHOTOBIOREACTORS WITH ALGAL-BACTERIAL GRANULAR SLUDGE

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1. INTRODUCTION

The wastewater treatment aims to remove pollutants to protect the quality of receiving water bodies and human health. However, there is an unbridled growth of natural resource use and scarcity, therefore, the concept of sustainability in the wastewater treatment industry is changing (MANNINA et al. 2019). In this context, technologies to treat wastewater with the possibility of obtaining value-added by-products from microorganisms (biomass) received more attention like aerobic granular sludge (AGS) and algal-bacterial (AGSB) technology.

Some value-added by-products of high commercial interest can be obtained from AGS and AGSB technology such as exopolymers that behave like alginate (ALE), Polyhydroxalcanates (PHA) and lipids. These by-products extracted from wastewater treatment systems are promising substitutes for conventional, non-biodegradable products from non-renewable sources such as solvents, conventional plastics, and fuels. ALE, can be used in the textile and paper industries enhance the performance of dyes and decreasing the use of the most common solvents (NANCHARAIAH AND REDDY, 2018). PHA behaves like a bioplastic possessing physicochemical characteristics like those of conventional plastics but are biodegradable materials and from renewable sources (MANNINA et al. 2019). Lipids can be used as feedstocks to produce biofuels, being an alternative energy source that provides a low pollutant emission rate (HUANG et al, 2020).

In this context, this work investigates the potential recovery of ALE and PHA in AGS and AGSB in sequential batch reactors fed with synthetic domestic sewage. As well as, to evaluate the lipid production by LGAB.

2. METHODOLOGY

Two sequencing batch reactors (SBRs) bench-scale made of acrylic were used, with 74 mm of internal diameter and 1000 mm of height, with a volume work of 2 L and volumetric exchange rate of 55%. The SBRs were named *R1 (with AGS)* and *R2 (with AGSB)* and cycles configuration of 4 hours was applied (anaerobic/anoxic feeding: 60 min; aeration: 176 min; settling: 3 min; and withdrawal: 1 min. The experiment was maintained at room temperature (26±2 ºC). The R2 was exposed to artificial lighting with a light intensity of 140 ± 20 µmol.m-2. s-1 with cycles of 12 hours light and 12 hours dark. The R1 was used without artificial lighting.

The PHA recovery potential was evaluated through of the measurement of crotonic acid that is formed by acid catalysis during the chemical depolymerization of PHB (KARR; WATERS AND EMERICH, 1983). The ALE recovery potential will be evaluated according to the methodology proposed by FELZ et al. (2016). For the analysis of lipid accumulation, the biomass from FRBS was first subjected to natural drying. The lipid extraction method was performed using Soxhlet in the presence of solvents: chloroform, methanol, in the proportion (2:1 v/v) chloroform: methanol. The analysis of the fatty acid profile will still be performed by gas chromatography, through the esterification of extracted fatty acids, using a temperature of 90°C in the presence of H_2SO_4 (Halim et al., 2011).

3. RESULT

In the first days of operation, the average ALE production was: R1: 704.9 ± 71.6 mg.VS_{ALE}/g.VS_{EPS} and R2: 686.3 ± 186.3 mg.VS_{ALE}/g.VS_{EPS}, similar values, thus indicating that the type of sludge did not influence the alginate recovery potential. We can also compare the results of the research with some obtained in the literature, such as that of Schambeck et al. (2020) in which they found an average amount of 333 ± 86 mg.VS_{ALE}/g.VS_{EPS} for aerobic granules fed with synthetic effluents, a much lower result compared to that found in the article. Regarding PHB production, in the anaerobic phase, the production averaged 11.95 ± 2.2 mgPHB/gTSS and 6.53 ± 1.8 mgPHB/gTSS for R1 and R2 respectively, thus demonstrating that the algal-bacterial consortium negatively influenced PHA production. In R2, with AGSB, lipid production was maximum on day 21 with a value of 452.23 mg/gTSS, with a decrease in lipid content from day 29 (Figure 1), which can be explained by the decrease in biomass caused by the development of the nematode *Aeolosoma Hemprichi*. Despite this, the result of this research is very promising when compared to the literature, where MENG et al. (2019), using reactors with similar operating conditions to those used in this work obtained a lipid content of 54.4 mg/gTSS.

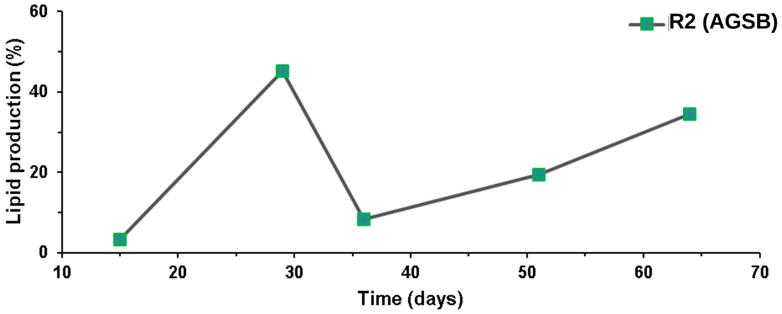

Figure 1. *Lipid production*

4. CONCLUSION

The study indicated promising results for the application of AGS and AGSB technologies for the recovery of aggregate by-products, but technical, economic and environmental feasibility studies are necessary for large-scale application.

5. REFERENCES

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