Assessing the environmental merits of added-value commodities yielded via hydrolysis of municipal biowaste in agricultural and biochemical applications

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1. Introduction

Municipal Biowaste (MBW) is a valuable feedstock utilized as a renewable substrate for obtaining a wide variety of bio-based products (BPs) (Kiran *et al* 2014). Many studies have shown promising applications of BPs as chemical auxiliary in the chemical industry and agriculture (Montoneri *et al* 2011; Photiou *et al* 2021). Some existing examples in the relevant literature comprise the use of BPs for textile dyeing, detergents manufacturing and hydrocarbons contaminated soil washing (Montoneri *et al* 2009; Savarino *et al* 2009).

The present study was carried out within the LIFE EBP project funded under the LIFE programme of EU. LIFE EBP aims to evaluate at pilot-scale, in the sectors of MBW management and agriculture, i) replication of the BPs production process, ii) assessment of BPs quality and cost, iii) validation of BPs performance as fertilizers, plant biostimulants and anti-pathogen agents and iv) confirm BPs compliance with EU regulation for agriculture and environmental policy. The technology will be tested in 4 EU countries.

2. Materials and Methods

Agricultural trials were conducted using tomato in an automate climate control greenhouse. Common agricultural practices for tomato were employed and 1-branch pruning based in vertical orientation/growth system. Pot size was at least 9 L and drip irrigation system was applied. Analyses included basic soil physicochemical analysis, plant growth, crop production, fruit quality and leaching. Treatments conducted with BPs application included addition of 150 kg/ha.

Experiments were conducted for food waste fermentation to produce biogas and digestate with low NH_3 content. The amount of BPs used in each treatment was between 0.05-0.2% (w/w) at 55 ^oC. Gas samples were analyzed for CH_4, CO_2, H_2, N_2, O_2 and N_2O using Gas Chromatography. Furthermore, the samples were analyzed for NO, NO_2 and NH_3.

3. Results and Discussion

Depending upon MBW source, inoculum and BPs content in fermentation, up to 68% reduction of ammonium was monitored in the digestate as compared to control experiments without BPs addition. The microbial community and biogas production were not significantly affected by BPs addition. The data are consistent with biological and chemical processes occurring in BPs assisted fermentation. These comprise ammonia production by protein hydrolysis catalysed by proteolytic bacteria and ammonia oxidation to N_2 catalysed by BPs. Moreover, the study will include data assessing the environmental merits of BPs addition in agricultural trials.

4. Conclusions

Based on the findings obtained, the fermentation of FW coupled to BPs addition is capable of significantly reducing the ammonia content of the digestate, producing elevated quantities of methane.

5. References

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