

Final valorization of algal biomass grown on wastewater

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When treating wastewater, an algal/bacteria consortia develops establishing synergistic relationships in which bacteria take advantage from the oxygen released by algal photosynthesis and algae use the CO₂ deriving from the bacterial degradation of organic matter.

Mixed algal/bacteria biomass grown on wastewater are not adequate as a raw material to recover high value products for the pharmaceutical, nutraceutical, and cosmetic industries.

The most obvious fates of algal/bacteria biomass are biomethane production in biogas plants, and/or agricultural use as fertiliser/biostimulant.

Batch tests were carried out to assess their Biochemical Methane Production (BMP) on samples of algal/bacterial biomass grown on different wastewaters: i) a mixture of blackwater from sludge dewatering (50%) and secondary effluent (50%), at pilot scale in an outdoor 90 L column bioreactor, ii) the liquid fraction of an agricultural digestate, in an indoor 10 L lab-scale column, iii) the liquid phase of a piggery wastewater, in lab-scale indoor glass tubes. The results were compared to the BMP of reference biomasses (waste sludge from wastewater treatment, manure) measured in parallel (Figure 1).

In the first two cases, sludge and cow manure showed a faster biomethane production than the tested algal/bacterial biomasses. However, the ultimate methane production from algal/bacteria biomass was higher. On the contrary, a much faster degradation was observed for the algal/bacterial biomass grown on piggery wastewater.

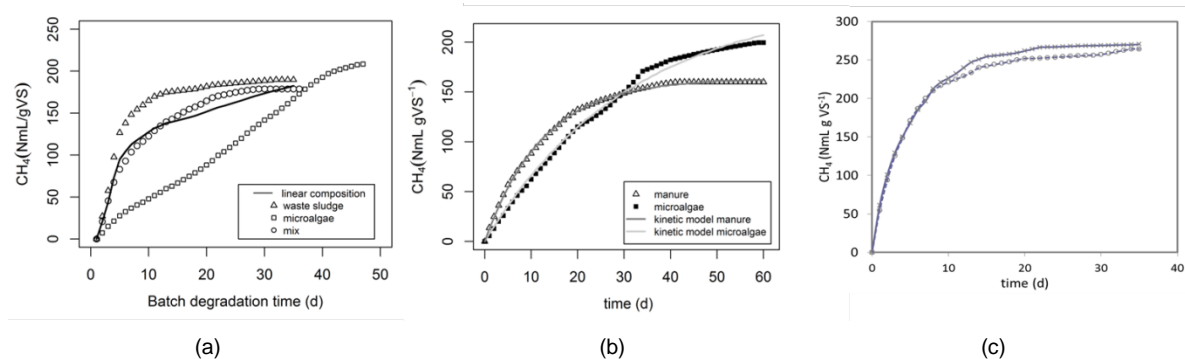


Figure 1 – BMP from algae/bacteria biomass grown on a mixture of blackwater from sludge dewatering (50%) and secondary effluent (50%) (a), the liquid fraction of an agricultural digestate (b), piggery wastewater (c)

To investigate the possibility of using algal/bacterial biomass in agricultural metal analyses were also carried out and compared to the limits in force for the agricultural use of sewage sludge. Metal concentrations in biomass grown on blackwater from sludge dewatering and on the liquid fraction of an agricultural digestate were always much below the limits. C, N and P concentrations also complied with the minimum threshold for agricultural use of sewage sludge.