Title:

Phycoremediation to treat wastewaters and digestates from farming and dairy sites in Northern Italy

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Abstract:

Algal based treatment has been tested at lab and pilot scale, to evaluate the ability of microalgae to remove nitrogen and to produce oxygen useful for bacterial oxidation processes. The lab-scale test concerned samples of digestate from a piggery farm (as such and after pre-treatment) and of piggery wastewater.

Lab-scale tests were performed in 150 mL glass tubes mixed by air bubbling, exposed to artificial light (130 µmol/m^2/s) 12 h/day, with 5 to 10 days hydraulic retention time (HRT). Pilot experimentations were carried out outdoor, in a raceway pond (RP) with 4 m^2 area (V =0.9 m^3) and 10 days HRT, fed continuously.

For microalgae valorization biomethane production (BMP) and possible agricultural use were evaluated.

The feeds were rich in ammonia nitrogen and, when concentration was too high, were diluted to avoid toxicity. The maximum NH_4-N concentration successfully used was 424±34 mg/L. The pre-treatment of digestate by activated carbon removed colour and improved its value as a substrate for algae.

In all cases microalgal biomass could grow, with average daily production rates between 220 and 330 mgTSS/L/day in lab-tests and 8.2 g TSS/m^2/d in the RP and algal counts in the range 10^6-10^7 cells/mL.

BMP from microalgae grown on piggery wastewater was 264-279 NmLCH_4/gSV in 260 days and metals in microalgal biomass complied with the limits for agricultural use of sewage sludge. Oxygen production by photosynthesis was over 50% of the demand for nitrification in the worst case and reached 100% in some cases.