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ABSTRACT

Advanced photo-biotechnology for the simultaneous control of VOCs, odours and GHGs emissions in municipal solid waste treatment plants

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Summary

Volatile organic compounds (VOCs) and odours emitted from industrial sources have been demonstrated as hazardous and annoying compounds which may cause negative effects on humans and environment. The control of these compounds is therefore a key action by the plant managers in order to avoid complaints and negative impacts.
The research presents and discusses the development and application of a smart advanced algal-bacterial photobioreactor (AB-PBR) designed by the SEED research group of the University of Salerno, for the treatment of high concentration of VOCs and odorous compounds in conveyed gaseous streams emitted from solid waste treatment plants. The research aims to promote a sustainable technology able to treat both hazardous VOCs and odorous substances in a circular economy perspective, through the production of algal biomass to be used for the production of biofuels. For the experimental activities tracer compounds representative of the investigated waste treatment plants were selected (e.g. toluene, ammonia, hydrogen sulfide). C*hlorella vulgaris* strain was chosen as photosynthetic platform due to their high adaptability to adverse environmental conditions. Active secondary sludge collected from a large scale civil wastewater treatment plant was used for the inoculation of bacteria consortium.
Laboratory experiments were conducted to investigate the technology in terms of efficiency removal of the aforementioned compounds and microalgal biomass production. Different operating conditions were tested and analyzed to optimize the AB-PBR. The influence of the variation of the tracer compound feeding time and the gas flow rate was carried out and discussed.
The results highlight in all examined conditions, removal efficiencies of up to 94% and elimination capacity (EC) of up to 1000 mg m^{-3} h^{-1} for toluene.

The synergistic effect of microalgae and bacteria proves the use of the AB-PBR not only for the abatement of VOCs but also for the odorous substances treatment. Finally, due to the microalgae biomass production it is possible to recover valuable compounds (e.g. biopolymers, fertilizer and feed) and produce biofuels contributing to improve the sustainability and energy balance of the overall process.

Indicate preference of kind of presentation

- ¤ Oral Communication
- ☐ Poster

Indicate topic of your work for the conference:

- ☐ Policy and associated regulations for odour and air quality.
- ☐ Odour/VOC measurement, monitoring&sensor technologies.
- ☐ Odour/VOC perception, impact, formation and dispersion.
- ☐ GHG emissions particulate matter and industrial emissions.
- ☐ Source characterization and odour/VOC mapping.
- ¤ Odour/VOC abatement, mitigation and neutralization.
- ☐ Odour/VOC from waste water, sewer systems and livestock.
- ☐ Air emissions and sustainable solutions for waste handling
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