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ABSTRACT

OVERCOMING BIOAVAILABILITY LIMITATIONS FOR THE TREATMENT OF LOW CONCENTRATION GASES SUCH AS ODOURS AND INDOOR AIR POLLUTANTS

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Contaminants such as long-chain hydrocarbons, with low aqueous solubility, may require an enhancement of the biofiltration performance. In addition, the low concentrations of air contaminants such as in odorous and indoor air typically cause increased mass transfer limitations and thus a reduced bioavailability.

Traditionally, the enhancement of mass transfer in gas–liquid contactors has been synonymous of an increase in power consumptions. Unfortunately, in gas treatment such as odorous foul air where the treated gas flow can be as high as 10^5 m^3h^{-1} and the footprint of the treatment equipment (e.g. biofilter) can be very large, the energy required to obtain good interfacial contact area between gas and liquid in turbulent reactors can be immense. Therefore, a structure (packed-bed) is used in laminar contactors (biofilters and biotrickling filters) to maximize the contact surface, but the lack of mixing in these systems leads to the presence of heterogeneities within the packed-bed. New strategies to increase mass transfer in gas treatment operations while minimizing the power consumption need to be developed.

In addition, studies on human exposure to indoor air pollution reveal that indoor environments could be at least twice as polluted as outdoor environments. The health threats caused by a long-term exposure to indoor air pollution as well as concerns about human well-being and productivity have become more apparent over the last decades as buildings are progressively sealed against the outside climate conditions to obtain heating and cooling energy cost savings and in response to stricter safety guidelines. Currently there is not a single technology that can efficiently provide a complete and satisfactory purification of indoor air. Biological systems for improving indoor air quality are promising, but challenges need to be considered to properly address the bioavailability of low pollutant concentrations.

This study focusses on researching advanced biological air purification methods as a ‘green’ alternative to physical-chemical methods, with the emphasis on improving bioavailability to enhance the treatment of odorous foul air and to improve Indoor Air Quality (IAQ) to both reduce system sizes and energy costs.
A capillary reactor with multiple capillary channels was built and operated under Taylor flow to assess the pollutant mass-transfer capacity and the biological treatment of low

concentrations (between 2 – 5 mg/m^3) of hydrophobic air contaminants. Initial results show removal efficiencies of about 50%, 90% and 95% for the model compounds hexane, toluene and α-pinene, respectively, at a gas contact time of less than 1 second.

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
- ☐ Community engagement, social media and citizen action.
- ☐ Other (suggest a new topic):

The scientific committee may change the session where authors propose to include their works.