RECOVERING THE PERFORMACE OF A BIOFILTER DEGRADING FORMALDEHYDE WITH THE ADDITION OF LOW OZONE CONCENTRATION

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Introduction. Formaldehyde (FA) was suspected to be carcinogenic since 1981 on the RoC. Nevertheless, was on 2011 that it was declared like human carcinogenic [1]. Building Sick Syndrome is caused by FA evaporation from paints, furniture, etc. [2]; biofiltration offers a solution to withdraw it from indoors, and to convert it to a less harmful compound, like CO_2. Although this technology must resolve some challenges: *i)* the low concentration that could be treated *ii)* the clogging, and *iii)* the mineralization. In a previous research, the injection of low concentrations of Ozone (O_3) enhances the performance and stability of a biofilter (BF) under high inlet loads for short periods [3], in spite of O_3 could affect the structure and the metabolic activity [4]. Thereby, further investigation in long term is needed in order to study *i)* the system robustness under high loads of FA with O_3 addition and *ii)* the effect on the microbial structure and the metabolic capabilities of an aerobic consortium able to uptake FA.

Methods. The experiment set-up was divided in two stages. During the first one FA load was increased from 20 to40 $gm^{-3}h^{-1}$, until the RE fall. The long term stability was tested during the 2nd stage. High FA loads from 40 $gm^{-3}h^{-1}$ to 90 $gm^{-3}h^{-1}$) were applied up to reached the steady state; the O_3 concentration used was 90ppb_v. However, the O_3 concentration could be increased if the RE falls. An acclimated inoculum was used in a BF packed with 3.3 L of perlite, with EBRT of 72 s. The biodegradation of FA was measured with GC/FID/TCD. The assessment of dynamic populations might highlight the influence of the FA inlet load increment and O_3 concentration on *i)* microorganisms viability, *ii)* the changes in the microbial structure and *iii)* the metabolic capability. A heterotrophic plate count will be carried out. Also it will be obtained a DGGE profile and the kinetic parameters (μ_{max}, K_s, $\hat{q}$, $Y_{x/S}$ $Y_{CO2/S}$) will be estimated in the second stage of the experiment.

Results. In the first stage (fig.1), the average Removal Efficiency (RE) obtained was 99.1±0.5 and it was maintained during 4 days before the BF experimented an acidification (pH=3.9 in lecheate) on day 42. This fall on RE was due to a high inlet load of 53, $gm^{-3}h^{-1}$ applied. The system, was recovered by backwashing with Mineral Medium (MM) and Phosphate Buffer Solution (PBS). The pH was maintained for 40 days at 7.9 and during the three inlet loads applied (Table 1).

Table 1. Steady state periods obtained during the BF operation.

Carga [$gm^{-3}h^{-1}$]	23.7±1.2	30.2±2.2	39.9±1.0
SS period [d]	52-66	71-90	92-94
ER [%]	96.5±1.2	99.0±0.7	97.9±1.7
pH lixiviate	8.1 ± 0.3	7.6 ±0.1	-

On day 95 the ER falls from 978 to 83% and consequently the pH was low (~6.7). At day 104, in the third increment the pH drop to 4.2, due to the high inlet load (40$gm^{-3}h^{-1}$).. After this result, the system was recovered by continuous addition of 90 ppb_v of O_3. During this second period the system have reached steady state with RE of 92 % under inlet loads around 40$gm^{-3}h^{-1}$.

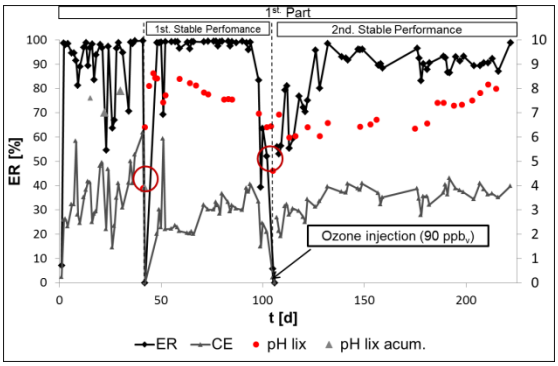

Fig. 1 Biofilter performance with two critic points (ER=0), highly dependent on load and two strategies of recover in long term.

Conclusions. The continuous addition of O_3 to a biofilter degrading FA at very low concentration could recover and maintain the long term performance and also, the pH in an optimal value.

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