BIODEGRADATION OF XYLENE ISOMERS IN A BIOTRICKLING FILTER UNDER INTERMITTENT AND CONTINUOS LIQUID FLOW

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Key words: biotrickling filter, xylene, biofilm

Introduction. The biotrickling filter (BTF) is one of the many promising biological techniques for removing volatile organic compounds (VOCs) present in waste air stream, such as gaseous emissions from chemical process. The BTF consists of a reactor containing microbes supported on synthetic medium, with nutrients commonly typically delivered at a minimal liquid flow rate. In operation of BTF, flow of liquid has the function of being the primary transport medium between pollutants in gas phase and the biofilm. It has been found a direct relationship between the liquid flow and contaminant removal capacity[1]. By other hand the main disadvantage of the BTF is the clogging arising from accumulation of excess biomass in the biofilter bed which progressively reduces the void volume of the carrier and may cause increasing of undesirable pressure drop and diminishing of VOCs elimination capacity.

The objective of this work was to evaluate the elimination capacity (EC) and removal efficiency (RE) in the operation of a biotrickling filter operated under both continuous and intermittent liquid flow.

Methods. Experimental runs were carried out in an acrylic BTF of 0.15m ID × 1.3 m packed length with 316 SS 0.5 in. Pall rings and void fraction initial of 0.95 (ε_B). A first BTF was operate in continuos form and a second BTF was operated under intermitent liquid flow with a cycle of recirculation of 30 min each 6 hours, to reach the pseudo steady state. The xylene isomers were used as carbon source and were fed at equimolar proportions during each experiment. The evaluated parameters were: EC and RE: The load of xylenes was kept at average concentration of 55 g/m^{3}h. The performance comparison in both BTF, corresponded at equal superficial liquid mass velocities of 14 kg/m^{2}s while the superficial gas mass velocities was kept at 4.47×10^{-2} kg/m^{2}s. The comparation presented corresponds at the same bed void fraction equal at 0.69.

All experiments were done at 30°C in a temperature controlled room.

Results. Comparison of both BTF, is shown in Table 1. The bed void fraction was of 0.69. The BTF operated under intermitent liquid flow condition reached higher EC than the BTF operated under continuos liquid flow condition. These results are opposite to the hypothesis of biofilm wetting[2] suggests that EC is better when the biofilm is wetted as in continuous liquid flow operation. In this work, under intermittent flow operation there was less trickling liquid and a better EC was reached. These results suggest that the direct transport gas ⇨ biofilm of xylene isomers its probably more important than the transport gas ⇨ liquid ⇨ biofilm.

Table 1. Comparison between intermittent and continuous operation of the liquid flow in a BTF for the elimination of xylenes

Operation	Time (days)	ε_B	Load (g/m^{3}h)	EC (g/m^{3}h)	RE (%)
Continuos	125	0.69	52±5	28±5	54
Intermitent	209	0.69	59±5	40±5	70

Conclusions. Elimination capacity and removal efficiency in BTF operated under intermittent liquid flow condition was better that continuos liquid flow. These results suggest that the direct transport gas ⇨ biofilm of xylene isomers is probably more important that transport gas ⇨ liquid ⇨ to biofilm in contrast with the hypothesis of wetting.

Acknowledgements. The authors would like to thank the Consejo Nacional de Ciencia y Tecnologí (CONACyT Mexico) for supporting this research work through a postgraduate grant, number 130403.

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