Application of Real-Time PCR to monitor inoculum survival during the removal of dimethyl sulfide in biofilters and biotrickling filters

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ABSTRACT. Reduced sulfur compounds are emitted to the atmosphere by industries like waste water treatment, Kraft pulping, animal rendering and composting (Ruokojarvi *et al*., 2001; Smet *et al*., 1996). Due to their obnoxious smell and low odor threshold, especially organic sulfur compounds, like dimethyl sulfide (DMS), often cause odor nuisance. Depending on the waste gas characteristics, biofilters or biotrickling filters can be used to eliminate the odor. Optimizing the inoculation strategy can be important to maximize the DMS elimination with both technologies. In the case of biofiltration, inoculation with e.g. *Hyphomicrobium* can increase the DMS elimination capacity (Smet *et al*., 1996). For biotrickling filtration, inoculation is always needed, but the choice of inoculum can potentially influence the DMS removal and reactor stability. In this study, Real-Time PCR was used to quantitatively monitor the fate of DMS-degrading inocula in biofilters as well as in biotrickling filters. Two primer sets were developed for the specific detection of *Thiobacillus thioparus* TK-m (Kanagawa and Mikami, 1989) and *Hyphomicrobium* VS (Pol *et al*., 1994).
In a first study, the DMS removal efficiency and the fate of the inoculum (*Hyphomicrobium* VS) was investigated in two compost biofilters, having different DMS inlet concentrations. During a period of 3 weeks, the biofilter receiving 1 ppmv DMS exhibited higher removal efficiencies (> 95%) than the biofilter receiving 20 ppmv of DMS (about 75%). The quantification of the inoculum with Real-Time PCR is currently being carried out.
In a second study, three inocula were compared for the removal of about 20 ppmv DMS in biotrickling filters. Three reactors were set up in parallel, inoculated respectively with *T. thioparus* TK-m, sludge or sludge + *T. thioparus* TK-m + *Hyphomicrobium* VS. Taking into account 5 criteria (start-up period, maximal elimination capacity, influence of intermittent feeding and peak loadings, biomass accumulation), the biotrickling filter with sludge showed the best performance. No significant benefit was observed by adding the two DMS degrading strains to the sludge. Real-Time PCR analysis showed, however, that both strains survived and maintained a quasi constant level on the rings. In the biotrickling filter inoculated with *T. thioparus*, the inoculum only constituted minor fraction of the total biofilm community.
In conclusion, both studies showed that Real-Time PCR is a powerful technique to analyze the fate of inocula, both in biofilters and biotrickling filters.

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