Effect of Pre-ozonation on the Wastewater Reclamation by the Combination of Ozonation and Soil Aquifer Treatment

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1. Introduction

Soil aquifer treatment (SAT) is a key technology for wastewater reclamation. This technology is cost- and energy- effective, and has been applied for various sites all over the world. The performance of SAT could be improved with other water treatment before and after SAT, and the performance of any water reclamation system should be evaluated as a whole system. In this study, to maximize the potential of SAT, the effect of pre-ozonation on the removal of organic compounds (i.e., DOC and other micropllutants) was evaluated. Also, post-zonation experiments were performed for comparison. For this purpose, a series of SAT experiments were conducted with sand columns at an HRT of 7 days. Target indices and compounds were DOC, EDTA, 1,4-dioxine, total trihalomethane formation potential, haloacetic acid formation potential, bromate ion, and five pharmaceuticals and personal care products (i.e., carbamazepine, clarithromycin, crotamiton, *N*,*N*-Diethyl-m-toluamide(DEET), sulpiride). Ozone dose was set to 5 or 10 mg/L for both pre- and post- ozonation.

2. Control of micropollutants and disinfection byproducts by the combination of ozonation and SAT

Higher DOC removals (approximately 10%) were observed for the sequence of preozonation and SAT than the combination of SAT and post-ozonation. This was probably due to the higher biological activities in SAT caused by smaller and more biodegradable organic compounds produced during pre-ozonation. Similar observations were found for EDTA, total trihalomethane formation potential, haloacetic acid formation potential. Most PPCPs were removed effectively by the three schemes tested (SAT alone, preozonation+SAT, SAT+postozonation. For DEET and 1,4-dioxane, the combination of SAT and postozonation was better.

3. Comparison between preozonation+SAT and SAT+postozoantion based on risk assessment

The preozonation+SAT process were compared with the SAT+postozonation process based on risk evaluation. In this evaluation, the risk of each compound/index was calculated based on the raito (r) of its actual concentration after treatment to its drinking water quality standard (or a guideline value). Then, depending on the r value, risk point of 0 (r <0.1, safe), or r (0.1< r <1, monitoring is needed). If r >1, the condition was ruled out for further discussion. Table 1 summarizes the risk points of the treatment scheme tested. It was found preozonation + SAT was the best option (1.27 points) when an ozone dose of 5 mg/L was applied.

Table 1 Summary of risk evaluation (unit: risk points)

	O_3(5)+SAT	O_3(10)+SAT	SAT+O_3(5)	SAT+O_3(10)
TCM	0.20	0.21	0.19	0.23
BDCM	0.41	0.45	0.35	0.45
T-THMs	0.35	0.37	0.32	0.37
DCA	0.19	0.15	0.23	0.23
EDTA	0.12	0.00	0.16	0.14
BrO_3	0.00	0.11	0.95	ruled out
Total	1.27	1.29	2.21	ruled out