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Nitrosamine removal: Pilot-scale comparison of advanced oxidation, nanofiltration, and biological activated carbon processes

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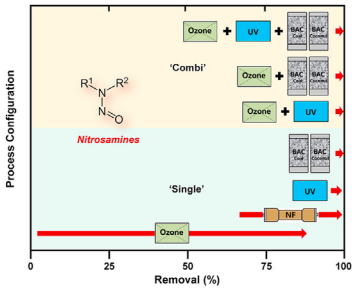
HIGHLIGHTS

- Pilot-scale water treatment processes were compared for nitrosamine removal.
- UV photolysis was more effective than ozonation but required >635 mJ/cm^2.
- Nitrosamine removal by BAC occurred through adsorption, with little biodegradation.
- Nitrosamines were desorbed with changes in feedwater quality.
- The combined use of UV and BAC ensures high degrees of nitrosamine elimination.

GRAPHICAL ABSTRACT



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ABSTRACT

Removal of nitrosamines from water intended for consumption is an important topic due to the carcinogenic risks they pose to human health. In this study, we measure and compare nitrosamine removal by four individuals and three combinations of water treatments applied in situ as a pilot study and in the laboratory. Of the two advanced oxidation processes tested, UV irradiation at a wavelength of 254 nm was more effective in nitrosamine removal than ozonation; however, the efficacy of UV photolysis required a high dose (>635 mJ/cm^2) for sufficient (>90%) removal of the contaminants. The biological activated carbon (BAC) process was also effective at removing nitrosamines, most of which were adsorbed onto the carbon. A small fraction (<10%) of nitrosamines were removed through biodegradation. Nanofiltration membranes were limited in removing nitrosamines, particularly *N*-nitrosodimethylamine, which is hydrophilic. Employing either UV or BAC treatments can warrant a high degree of elimination of nitrosamines; however, desorption of nitrosamines from BAC can occur due to variations in the quality of source water and the types of carbon filters used. Combined treatments using both UV and BAC processes offer promising alternative strategies for removing nitrosamines when treating water for human consumption.

1. Introduction

Nitrosamines, including N-nitrosodimethylamine (NDMA), garner serious attention because of their mutagenic and

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