Use of Micronano Bubble Ozone for Removing Pharmaceutically Active Compounds from Wastewater

Sub-Theme 3

UNESCO-IWRA ONLINE CONFERENCE 17-19 JANUARY 2023 3rd IN THE IWRA ONLINE CONFERENCE SERIES

Abstract

The focus was to explore the applicability of the use of Micronano bubbles (MNBs) as a replacement of conventional bubbles in the PACs removal from wastewater. In this study, physico-chemical changes during the ozonation with MNB technology (O3-MNB) is investigated for PACs removal from wastewater. A recalcitrant water soluble pharmaceutical organic, namely, caffeine that is present in municipal water systems was chosen for study in the lab scale set up.

Background

Innovative treatment technologies with higher efficiencies and lower costs are urgently needed for PACs removal at the wastewater treatment plants (WWTPs) before their discharge or reuse. Therefore, the key focus of this research is to maximize the removal of PACs during the disinfection process at the WWTP.

Objectives

The main objective of this research was to study the application of MNBs for PACs removal by:

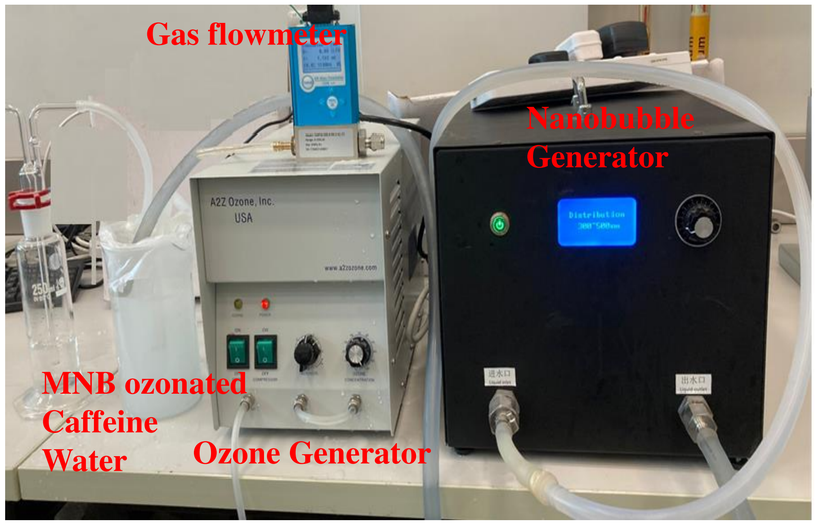
(1) MNB production using MNB generator in caffeine containing water and study its characteristics

(2) Bench scale study to understand removal of caffeine by MNB ozonation, and compare with conventional ozonation

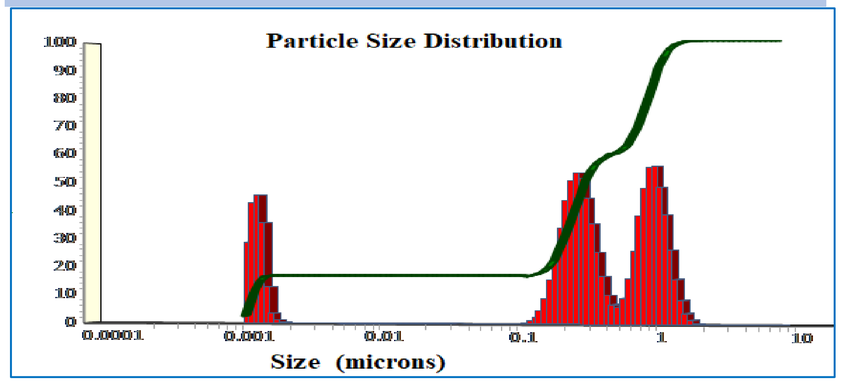
Materials and Methods

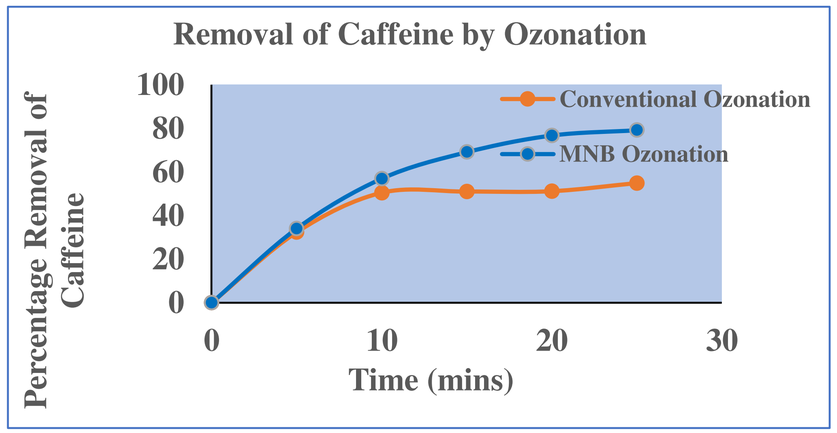
The MP-5000 Ozone Generator (A2Z Ozone Inc., USA) was used to feed ozone into NB-200-10 Model microbubble generator (China) to generate O3-MNB as dissolution in the sealed batch reactor. Microtrac MRB's NANOTRAC Wave II Particle Analyzer (Germany) was used to analyze the ozone-MNB characterization and bubbles distribution at regular intervals. Concentrations of caffeine in the reactor were measured via direct ultra-violet absorption (Hach DR6200 at 272 nm). Other parameters like pH, DO, temperature were also measured at regular intervals during and after the ozonation process.

Experimental Setup



Results





Conclusions

- Nanoparticle analyzer results showed that the microbubble generator produced a good concentration of MNBs
- Initial experiment results showed better removal of caffeine (80%) using MNB ozone. This shows that MNB ozonation at controlled condition would lead to efficient removal of PACs

Mohamed Ibrahim Kizhisseri, Postdoctoral Researcher, UAE University, UAE, Al Ain