



Investigation of urea behavior in water treatment and wastewater reuse plants as potential sources for ultrapure water

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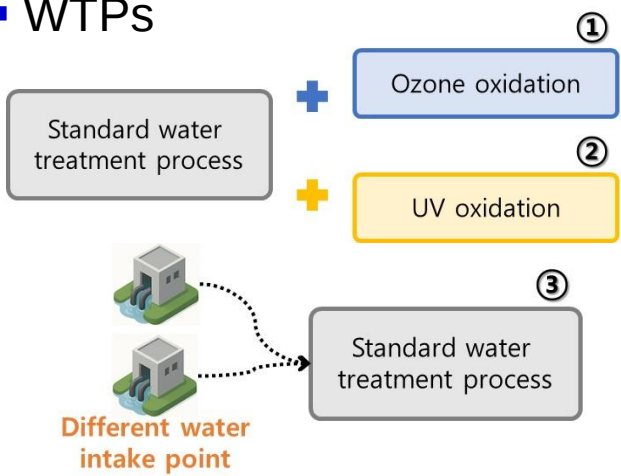
Introduction

- Wastewater reuse can be a source of raw water for ultrapure water(UPW) for semiconductors.
- However, urea is one of the main limiting factors for wastewater reuse when it is utilized as a source of UPW due to its characteristics, such as its low molecular weight, resistance to oxidation, etc.
- In this study, the behavior of urea was investigated in water treatment plants (WTPs) and wastewater reuse treatment plant (WRTP) to establish a strategy for utilizing wastewater reuse as an UPW raw water source.

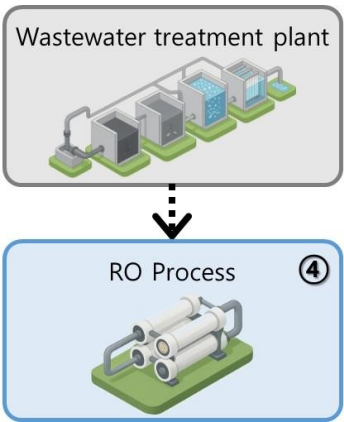
Materials and Methods

WTPs and WRTP

WTPs



WRTP

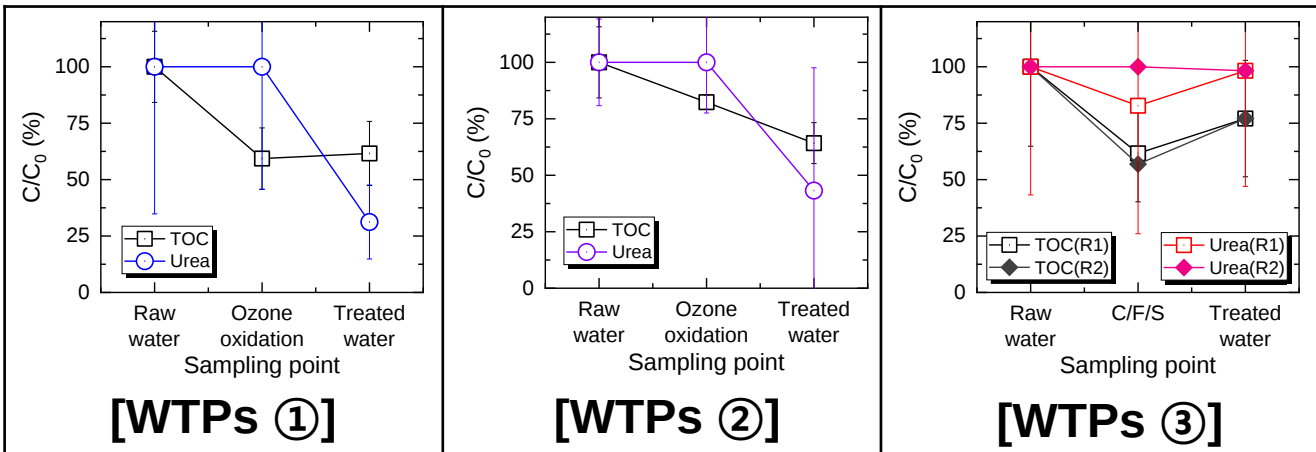


Analysis of Samples

Contents	Water quality factor	Urea	DOC	UV/VIS @ 254 nm	Alkalinity
Analysis methods	pH, Conductivity	LC-OND (DOC-Labor GmbH, Germany)	TOC-L Series (Shimadzu, Japan)	HS-3700 (HUMAS, Korea)	pH titration method

Results and Discussion

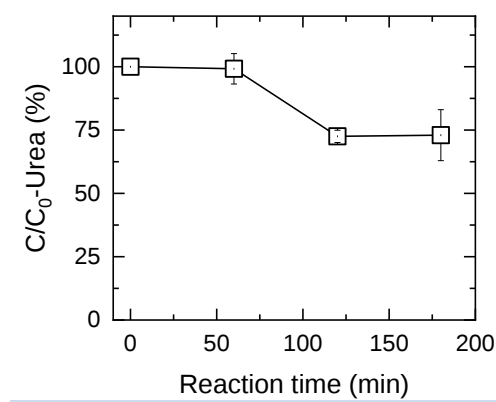
Change of water quality : WTPs



	Raw water			
	WTPs ①	WTPs ②	WTPs ③*	
			R1	R2
pH	7.5 ± 0.3	7.7 ± 0.3	7.8 ± 0.7	7.3 ± 0.2
Conductivity	228.3 ± 12.6	235.9 ± 14.1	723.7 ± 305.3	154.2 ± 9.2
TOC (mg/L)	1.9 ± 0.3	1.2 ± 0.3	5.4 ± 1.9	2.7 ± 0.9
Urea (μg/L)	26.3 ± 5.0	31.2 ± 16.4	140.9 ± 80.0	23.4 ± 15.8

- *WTPs ③ : Raw water, which is intaken from different points, is mixed in a 7:3 ratio after C/F/S treatment (treated water)
- The urea conc. varies depending on the source of raw water.
 - AOPs(O₃, UV) are not effective in urea removal.

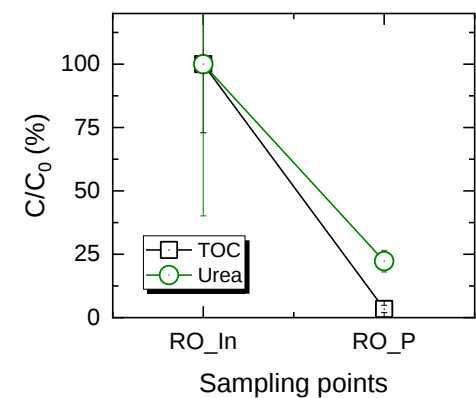
Decrease of urea with residual chlorine



Initial condition
- 10 μM-Urea / 50 μM-Cl

- The required reaction time between urea and residual chlorine : **about 2 hours**
- The decrease in urea in the treated water storage is due to residual chlorine.

Change of water quality : WRTP



- RO influent : 5.8 ± 1.6 mg/L-TOC, 56.4 ± 33.8 μg/L-Urea
- The urea removal in the RO process : **80~88%**.
- Urea degradation may have been enhanced by biofilm formation on the reverse osmosis membrane.

Coclusions

- Urea concentration is affected by the type of raw water and is difficult to control using traditional oxidation processes.
- To utilize wastewater reuse as a raw water source of UPW, continuous urea monitoring is necessary, and an effective method is required to control urea according to changes in inflow concentration.

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