# Effect of the Temperature and UV Reflector on the AOP Decomposition Behavior of the Oxalates From the Chemical Decontamination Waste

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## 1. Introduction

Oxalic acid ($H_2C_2O_4$) is one of organic solvents used in nuclear industry. It is used as decontamination reagent for removing oxidation deposit that is formed at NPP system surface [1]. Especially, oxalic acid has feature that it is decomposed into $CO_2$ and $H_2O$. It is needed to remove remained oxalic acid which chelates with oxidation deposit [2].

In water treatment industry, advanced oxidation processes (AOPs), which decompose organics by forming OH radical from combination of UV, $O_3$ and $H_2O_2$, is studied.

In previous study, UV/$H_2O_2$ showed higher efficiency than other AOPs and it was applied easily [3]. In this study, therefore, UV/$H_2O_2$ process was applied for decomposing remained oxalic acid and effect of temperature and UV reflector, which were selected as influence factors in UV/$H_2O_2$ process, was estimated.

## 2. Experiments

### *2.1 Preparation of waste water and estimation of decomposition extent*

The volume of waste water which was subject of decomposition in this study was set to 800 mL to maximize contact area of UV lamp. As the remained oxalate after removing oxidation deposit chelate with iron and chrome, 2 mM ferric chloride ($FeCl_3$), 1mM chromium nitrate ($Cr(NO_3)_3$) and 30 mM oxalic acid were mixed to prepare waste water. The extent of oxalic acid decomposition is estimated by total organic carbon (TOC) analysis.

### *2.2 Estimation of effect of temperature*

50 mM hydrogen peroxide was used in UV/$H_2O_2$ process for removing remained oxalate in waste water. The temperature in UV/$H_2O_2$ process was set to room temperature, 50℃, 60℃ and 70℃ respectively and the decomposition of oxalate was conducted for 5 hours

### *2.3 Estimation of effect of UV reflector*

In this study, quartz reactor was used for UV/H2O2 process as shown in Fig. 1. In order to confirm effect of UV reflector, the outside of quartz reactor was covered by aluminium foil to reflect UV light. 30 mM hydrogen peroxide was used in UV/$H_2O_2$ process and the decomposition was conducted for 2 hours.

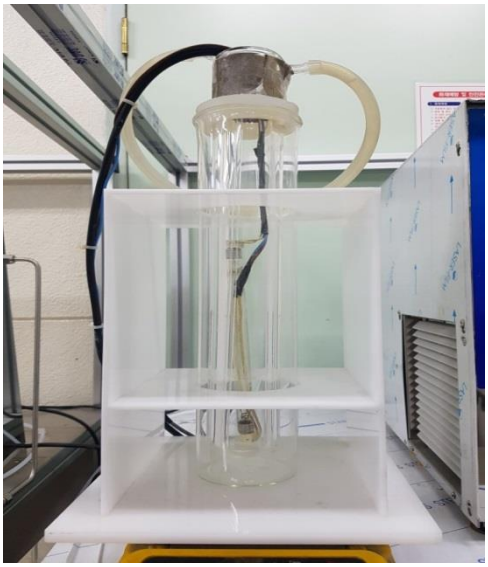

Fig. 1. Quartz reactor.

## 3. Results

### *3.1 Estimation result of effect of temperature*

The decrease of oxalic acid concentration was represented in Fig. 2 to compare results of decomposing oxalic acid according to temperature in

$UV/H_2O_2$ process. At higher temperature, the rate of decomposing oxalic acid decreased slightly and more oxalic acid, finally, was remained.

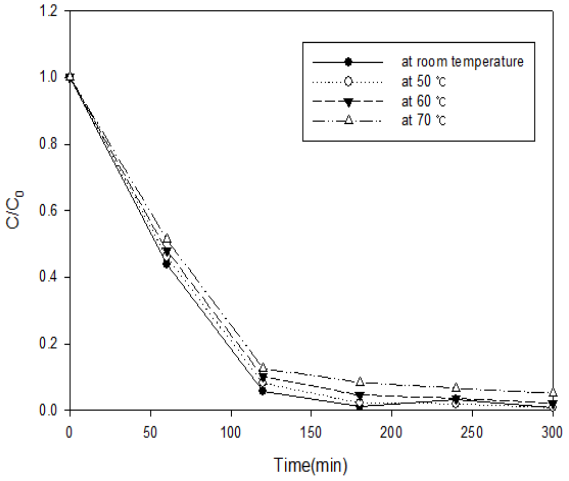


Fig. 2. Decomposition extent of oxalic acid according to temperature.

*3.2 Estimation result of effect of UV reflector*

The decrease of oxalic acid concentration by $UV/H_2O_2$ process was represented in Fig. 3 according to existence of UV reflector. It was confirmed that the rate of decomposing oxalic acid was increased slightly when UV reflector was used in $UV/H_2O_2$ process.

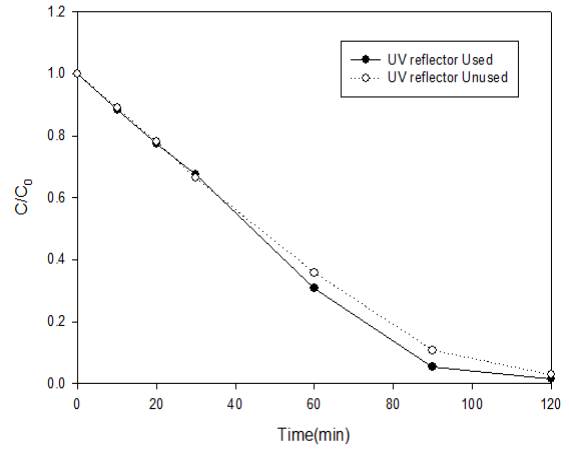


Fig. 3. Decomposition extent of oxalic acid according to existence of UV reflector.

## 4. Conclusion

The influence of temperature and UV reflector on the AOP kinetics of the oxalates from the chemical decontamination wastes containing the metallic ions was studied experimentally. We obtained the following conclusion in the experimental ranges:

1. The influence of temperature is considered to be limited, even though increasing temperature results in slight decrease in decomposition rate.
2. The role of the UV reflector is considered as unimportant factor, even though it slightly increases the decomposition rate.

## Acknowledgement

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