A Study on the Radioative Decomposition Characteristics of Oxalic Acid Using Metal Catalysts

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1. Introduction

Oxalic acid radiators, boilers and other major components are as follows. Textile manufacturing, dyeing, metal extraction and purification, bleaching of leather or leather. Another source of energy is the element containing the eliminating element.1-2)

Oxalic acid such as potassium permanganate or chromic acid may be used to treat oxalic acid remaining in the wastewater for various purposes. However, new researches are underway to remove oxalic acid because of the disadvantages of a large amount of chemicals and a relatively large amount of residual wastes.1-3)

Recently, a method of treating oxalic acid using AOP (Advanced Oxidation Process) has been attempted. In AOP, OH radicals ($OH^{\cdot}$, Potential difference: 2.8 V) is generated to treat the organic matter.

In the general AOP method, a method of adding ozone, hydrogen peroxide, or the like in parallel is already well known. Several researchers have also introduced a process to improve the TOC removal effect by applying sulfate salts and metal salts in the form of sulfate in the ozone / catalyst process.1-4)

In this study, sulphate type Fe (Ⅱ), Cu (Ⅱ) and Ni (Ⅱ) were used to apply ionizing radiation (electron beam) / metal catalyst process. Experiments were carried out to remove oxalic acid in water by using OH radicals in water by acting electron beam and a small amount of transition metal ions like catalyst.

2. Main subject

2.1 Materials and methods, analysis

2.1.1 Sample preparation. The initial concentration of oxalic acid (Oxalic Acid, 99 +%, 144-62-7, Aldrich Chemical Company, Inc.) was set at 2 mM and the total volume of the sample was fixed at 10 mL.

2.2 Radiation (electron beam) irradiation

All the irradiation experiments were carried out with the electron beams of the electron beam accelerator units 2 and 4 of EB-Tech (170-9, Techno 2-ro, Yuseong-gu, Daejeon, 34028, KOREA). The maximum electron energy is 2.5 MeV. All investigations were carried out at room temperature. The absorbed dose of radiation was 5, 10, 30, 50 kGy.

The sample was allowed to have a depth of 0.7 cm in a beaker (150 mL of glass beaker) so that the electron beam could be irradiated uniformly.

2.3 Experimental apparatus and analysis apparatus

The concentration of oxalic acid was analyzed using High Performance Liquid Chromatography (HPLC) (Agilent Technologies, 1200 series). Rezex ROA-Organic Acid H + (8%) (300 × 7.8 mm) was used as the column. The mobile phase used 0.005 N sulfuric acid. TOC-VCSN TOC analyzer (Shimazu, kyoto, Japan) was used to measure total organic carbon.

3. Result

Fig. 1 shows the results of decomposition of oxalic acid by radiation (electron beam) irradiation.

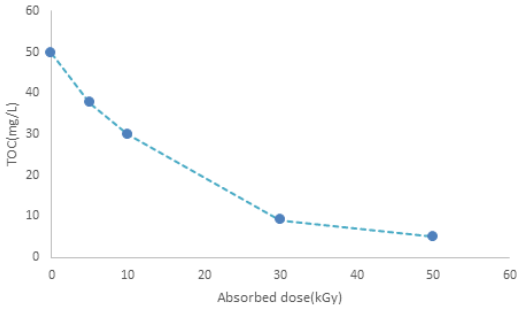

Fig.1. Total Organic Carbon change of oxalic acid by electron beam.

Fig. 2 and 3, show the results of irradiation of the metal catalyst (Cu, Ni) added to oxalic acid.

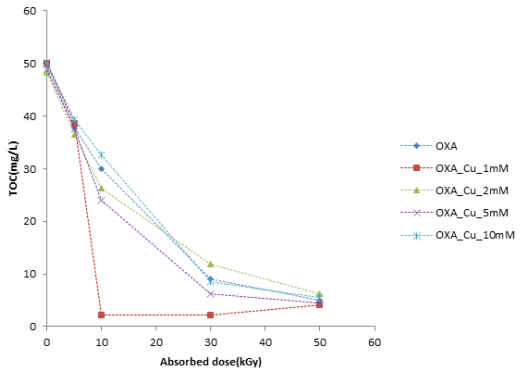

Fig.2. TOC change of oxalic acid by electron beam (Cu addition).

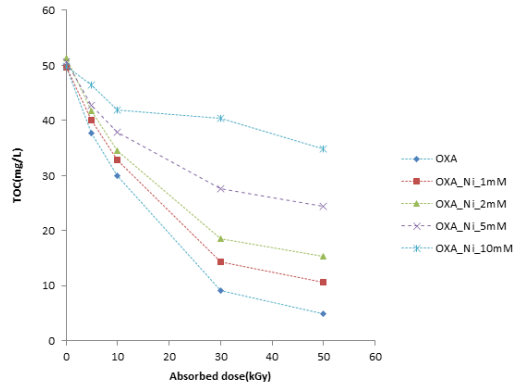

Fig.3. TOC change of oxalic acid by electron beam (Ni addition).

4. Conclusion

The following conclusions were obtained through the electron beam irradiation process and the electron beam irradiation process with various chloride metal salts added. Compared with the case of using only the electron beam without using the metal catalyst and the process using the metal catalyst, the addition of Fe and Ni to oxalic acid resulted in a decrease in the decomposition rate of oxalic acid.

However, in the case of Cu, before the electron beam irradiation, the TOC was decomposed according to the change in the concentration of Cu, and it was found that the efficiency was improved when the electron beam was irradiated. Therefore, it is expected that the process of adding Cu as a metal catalyst to the decomposition process of irradiating the electron beam to oxalic acid will have a decomposition effect.

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