27aC05

水中気泡内放電によるジクロロメタンの分解と微生物処理方式との併用
Decomposition of Dichloromethane by Combined Process of Biodegradation and Discharge inside Bubble in Water

高橋克幸，晴山渉，高木浩一，颯田尚哉
TAKAHASHI Katsuyuki, HAREYAMA Wataru, TAKAI Koichi, SATTA Naoya

岩手大学
Iwate University

1. Introduction

Dichloromethane (DCM) is one of hazardous chlorinated volatile organic compounds and is difficult to decompose owing to its chemical stability. In this study, the decomposition of DCM by combined process of biodegradation and discharge inside bubble in water is investigated.

2. Experimental setup and procedure

The discharge treatment system used in this study was described in the previous paper [1]. Ar gas is injected into the reactor at gas flow rate of 30 mL/min. The peak value of the output voltage is 16 kV. The pulse repetition rate is fixed at 100 pulses per second.

DCM is dissolved into 15 mL of purified water at concentration of 73.8 or 443 mg/L. DCM removal efficiency and decomposition efficiency are obtained by the concentrations of total organic carbon and chloride ion in the solution, respectively [2].

Aerobic DCM-degrading microorganisms collected from the groundwater at illegal waste dump site [3], and are employed for biodegradation after the discharge treatment with mineral salt medium. After the discharge treatment, 0.06 g of activated carbon made from poultry manure is added to the solution to decrease hydrogen peroxide produced by the discharge, and the pH is adjusted to 6 by adding NaCl.

3. Experimental Results

Figure 1 shows DCM removal efficiency and DCM decomposition efficiency as a function of discharge treatment time. The initial DCM concentration is 73.8 mg/L. The DCM removal efficiency increases without discharges because of volatility of bubbling gas. The DCM removal efficiency and decomposition efficiency with discharges at treatment time of 25 min are 96% and 80%, respectively, which indicates that approximately 83% of removed DCM is decomposed into hydrogen chloride [2] by discharges.

Figure 2 shows the DCM removal efficiency as a function of biodegradation time after the discharge treatment. The initial concentration of DCM is 500 mg/L. The discharge treatment time is 12.5 min. The DCM removal efficiency is 84% at the end of discharge treatment. Without discharge treatment, the

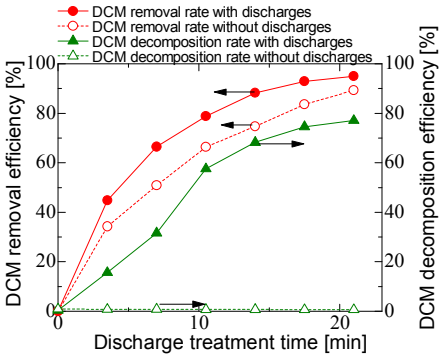

Fig. 1. DCM removal efficiency and decomposition efficiency as a function of discharge treatment time with or without discharges.

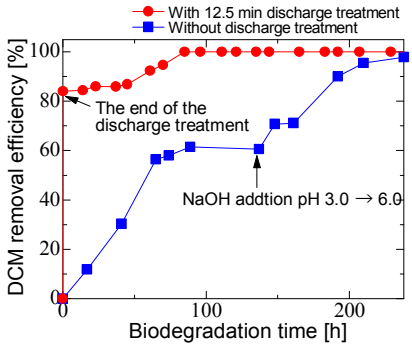

Fig. 2. DCM decomposition efficiency as function of biodegradation time with or without discharge treatment.

pH value decreases from 6.5 to 3.0 in approximately 150 h due to the decomposition of DCM. NaOH is added at 150 h to adjust the pH value because the decrease of pH prevents bacteria from decomposing DCM. With discharge treatment, the DCM is removed completely at 85 hour without pH adjustment during the process. This result shows the treatment time is significantly reduced by the combined process.

References

1) S. Kawano, et al., J. Phys.: Conf. Ser, 441, (2013) 012007
2) Yonezawa, et al., J. Inst. Electrostat. Jpn, 35, (2011) 31-37
3) Q. Yimiti, et al. Resour. Process., 58, (2011) 47–51