

# OPC19) Quantitative Toxic Effects of Binary Combinations of Three Heavy Metals (Cd, Cu, Zn) on Bacterial Growth and Phosphorus Removal in the Mixed Culture of *Alcaligenes* sp. plus *Pseudomonas* sp.

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## 1. 서론

Much of the research on the effects of mixing two or more heavy metals has been done on fish and shellfish or plants. However, there is not enough information about these effects on microorganisms. Therefore, it is necessary to evaluate the interactive toxic effects of mixed heavy metals on bacteria.

## 2. 자료 및 방법

Treatment concentrations of single heavy metals are 0, 0.2, 0.4, 0.6, 1 mg/L of cadmium, 0, 3, 6, 9, 15 mg/L of zinc, 0, 4, 8, 12, and 20 mg/L of copper. The binary heavy metal treatment concentrations are the sum of the treatment concentrations for each single heavy metal. For example, when zinc and copper are mixed, the concentration of each treatment category is 0 (0 + 0), 7 (3 + 4), 14 (6 + 8), 21 (9 + 12), 35 (15 + 20) mg/L.

## 3. 결과 및 고찰

In the case of growth, as the concentration of the treated heavy metal increased, the OD<sub>600</sub> value of the microorganism was found to decrease. As a result of comparing the inhibitory effect based on the IC<sub>50</sub> concentration (see, table 1), it was confirmed that the inhibitory effect on growth was high in the order of Cd, Zn, Cu in single heavy metal treatment and Cd + Cu, Cd + Zn, Cu + Zn in the order of mixed heavy metal treatment. In the case of phosphorus removal, as the concentration of the treated heavy metal increased, it was confirmed that the P removal efficiency by microorganisms decreased. As a result of comparing the inhibitory effect based on the EC<sub>50</sub> concentration (see, table 1), it was confirmed that the inhibitory effect on P removal was high in the order of Cd, Zn, Cu in single heavy metal treatment and Cu + Zn, Cd + Cu, Cd + Zn in the order of mixed heavy metal treatment.

**Table 1.** IC<sub>50</sub> and EC<sub>50</sub> of *Alcaligenes* sp. and *Pseudomonas* sp. with heavy metal treated

Heavy metal treatments		IC <sub>50</sub> (mg/L)	EC <sub>50</sub> (mg/L)
single	Cadmium (Cd)	0.75±0.03c	0.54±0.03c
	Copper (Cu)	10.93±0.20a	11.08±0.65a
	Zinc (Zn)	7.08±0.28b	6.14±0.65b
binary	Cd + Cu	6.35±0.49c*	7.24±0.49b*
	Cd + Zn	7.78±0.38b*	6.66±0.39b*
	Cu + Zn	14.83±0.72a*	13.40±0.91a*

\* Means in the followed by letter are significantly different by ANOVA at  $\alpha$  0.05 level.

## 4. 참고문헌

Di Cesare, A., Eckert, E., Corno, G., 2016, Co-selection of antibiotic and heavy metal resistance in freshwater bacteria, *Journal of Limnology.*, 75.