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Application of stratified ZnS photocatalysts against to the water clarification materials

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1. Introduction

It is widely confirmed that water crisis have been revealed in various countries in the world. Thus, it can be said that the techniques for stable supply of water is quite important. "Water" in our life can be classified into two categories. One is drinkable water, and other is daily life water. Former required high cleanliness, while we can use recycled water for the letter by utilizing the clarification and bactericidal technology. Traditional bactericidal technology can provide the clean water, nevertheless it has some problems, such as high cost, contamination and others. Thus, it is true that recycled water was not utilized effectively, especially in developed countries. Therefore, the technology which can produce highly clean water by low energy and low costs should be developed.

There are many reports for antibacterial effect of nanoparticles (NPs)[1]. Among these, zinc oxide and/or sulfide photocatalysts shows high antibacterial and self-cleaning property by photocatalytic effect. We reported the ZnS photocatalysts with specific morphology which has nano-sized and capsule-like form, called as stratified photocatalysts (s-ZnS)[2]. These materials show extremely high photocatalytic activity, however, the application against to water clarification materials was not achieved.

Therefore, in this study, the properties of stratified ZnS photocatalysts and also various oxide/sulfide NPs against to the water clarification effects was evaluated.

2. Experimental

Bactericidal properties of s-ZnS, ZnS, ZnO and TiO_2 NPs (ST-01:ISK) were evaluated by obeying to the following methods. First, cell concentration of *E.coli* (NBRC3972) was adjusted to a constant concentration in a test tube. The materials are dispersed into the tubes, with the concentration of 1.03×10^{-2}M. The number of viable cells was measured after disinfecting under dark conditions for 16 hours. Since s-ZnS has nano size wall consisting nanoparticles and it has a nano-hetero junction between ZnS and ZnO, the proportion of each was evaluated by utilizing the difference of solubility (ICP-OES).

3. Result and discussion

Fig.1 shows aerobic viable counts after bactericidal activity evaluation. Here, low remaining number means the high activity. Thus, it can be confirmed that s-ZnS shows the very high bactericidal activity (99.98%).

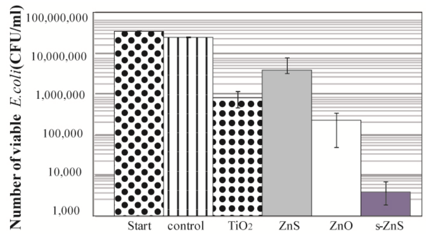

Fig.1 Viable counts after bactericidal activity test

Fig.2 shows the results of the alkaline elution test. This result means that ratio of ZnO in s-ZnS was estimated to <1%. Fig.3 shows the relationship between the remaining number of bacterium and the ratio of ZnO in ZnO-ZnS NPs mixed samples. That of s-ZnS was also inset in figure. As shown in this figure, bactericidal property of s-ZnS is higher than the other materials, and this property is originated from its specific morphology.

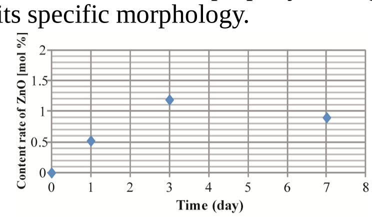

Fig.2 Content of ZnO in s-ZnS

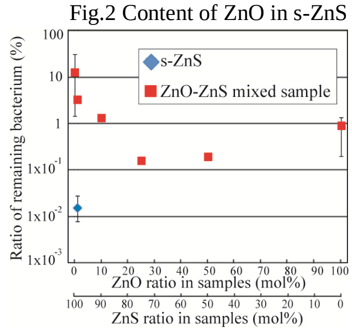

Fig.3 Relationship between bactericidal activity and mix ratio of ZnO and ZnS in Zinc materials

4. Conclusion

Stratified ZnS photocatalysts shows high purification efficiency of water. Other results will present in our presentation.

Acknowledgement

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References

1) Chang, Y.-N et.,al Materials (2012) 5, 2850-2871 2)T. Arai, et.,al Proc. Int. Symp. on Cluster Assembled Mater, IPAP Conf. Series,3, (2001)75-78.