

NaDCC 주입 선박평형수 처리기술의 해양생태위해성에 대한 연구

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Ecotoxicological Effects of NaDCC injection method in Ballast Water Management system on Marine Environments

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Abstract

Effluent treated by an NaDCC injection method in Ballast water management system (BWMS) contains reactive chlorine species and disinfection by-products (DBPs). In this study, we conducted whole effluent toxicity (WET) testing and ecological risk assessment (ERA) to investigate its ecotoxicological effects on marine environment. WET testing was carried out for four marine pelagic and freshwater organisms, i.e., diatom *Skeletonema costatum*, *Navicula pelliculosa*, chlorophyta *Dunaliella tertiolecta*, *Pseudokirchneriella subcapitata*, rotifer *Brachionus plicatilis*, *Brachionus calyciflorus* and fish *Cyprinodon variegatus*, *Pimephales promelas*. The biological toxicity test revealed that algae was the only biota that showed apparent toxicity to the effluent; it showed no observed effect concentration (NOEC), lowest observable effect concentration (LOEC) and effect concentration of 50% (EC50) values of 25-50%, 50-100% and >100%, respectively, at three water condition, but did not show any significant toxicities on other biota. Meanwhile, chemical analysis revealed that the BWMS effluent contained total residual oxidants (TROs) below 0.03 µg/L and a total of 25 DBPs such as bromate, volatile halogenated organic compounds (VOCs), halogenated acetonitriles (HANs), halogenated acetic acids (HAAs), chloropicrin and Isocyanuric acid. Based on ERA, the 25 DBPs were not considered to have persistency, bioaccumulation and toxicity (PBT) properties. The ratio of predicted environmental concentration (PEC) to predicted no effect concentration (PNEC) of the other DBPs did not exceed 1 for General harbor environment. However, four substances (Isocyanuric acid, Tribromomethane, Chloropicrin and Monochloroacetic acid) were exceed 1 for Nearship environment. But observed toxicity in the test water on algal growth inhibition would be mitigated by normal dilution factor of 5 applied for nearship exposure. Thus, our results of WET testing and ERA showed that the BWMS effluent treated by NaDCC injection method would have no adverse impacts on marine environment.

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