SUPPRESSION OF NUTRIENT RELEASE BY POROUS CARRIER OF BLAST FURNACE SLAG AND ARTIFICIAL ZEOLITE

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Introduction

Large quantities of nutrients released into enclosed sea areas are leading to eutrophication and consequent impact on aquatic environment. Recently, a water quality improvement method was developed in which the polluted sediments are covered with sand to suppress release of nutrients. However, it may become difficult to get seabed sand in near future and hence it is essential to find alternative covering material instead of sand.

In an earlier study, a porous carrier made from industrial solid wastes such as blast furnace slag and artificial zeolite has shown the ability to adsorb phosphate and ammonium due to the presence of slag and zeolite, respectively. The present study aims to use the porous carrier as covering material instead of sand. Laboratory experiments were carried out to investigate the effect of porous carrier to suppress the release of nutrients.

Methods of study

In the laboratory experiment, a 2-cm thick layer of porous carriers, sand and glass beads were respectively used in separate containers to cover a 20-cm thick layer of sediment. Later, 400 ml of seawater was added to a each of the containers and then bubbled with N_2 gas to adjust DO to less than 0.1 mg/l in order to create an anaerobic condition. Experiments were conducted in the dark condition at temperature of 25C. Temporal changes of DO, pH, NO_3^-, NO_2^-, NH_4^+ and PO_4^{3-} were measured throughout the experiment.

Result

(1) At the beginning of the experiment, pH of the sea water added was 7.8 ± 0.1 (mean $\pm$ SD). The pH has decreased down to 7.6 ± 0.1 after several days in the containers with sand and glass beads coverings, while in the container having the porous carrier it has increased up to 8.3 ± 0.1. The release of calcium ion from the porous carrier is considered to have increased the pH in the container. (2) Nitrite and nitrate concentrations had decreased in all containers. (3) The porous carrier had suppressed the increase of ammonium derived through the reduction of nitrite and nitrate as well as released from sediment. (4) The sand and glass beads also suppressed release of phosphate from the sediments. However, the porous carrier could adsorb the phosphates released from the sediment and originated from the seawater.

Based on the experiment, it is concluded that the porous carrier was able to suppress the release of nutrients from sediment under anaerobic conditions and hence is useful for sediment improvement as a covering material instead of sand.