SHORT COMMUNICATION

EFFECTIVENESS OF RECYCLED WASTE GLASS AS A CONTAMINATED TIDAL MUD IMPROVEMENT MATERIAL

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The Ariake Sea having a unique feature is one of the best-known semi-closed shallow seas in Japan. The total area of this sea is 1700 km^2 with an extended 96 km of the bay axis and an average width of 18 km. The vast tidal flat mud of the Ariake Sea, which is almost 40% of the total tidal flat area of Japan, is famous for its rich fishery products and *Porphyra sp.* cultivation. The tidal height at the flood tide is about 3 m in the bay mouth area, and it becomes bigger in the bay head area with the tidal height of 4.5-5.0 m. Azad et al., (2005) mentioned that many rivers flow into the eastern coast area of the Ariake Sea and carry 4.4 x 10^8 kg of sediments per year. Kato and Seguchi (2001) conducted tests and showed that coarse sediments accumulate in the eastern coast, and fine grains brought by the residual current accumulate in the bay head to form vast tidal flats with fine sediments. Cyranoski, 2001; Zhang et al., (2004), mentioned that environmental issues related to the Ariake Sea have been a topic of increasing interest recently and analysis of characteristics of tidal flats is of great interest to the regional population.

Ariake sea is situated in the north-western part of Kyushu island in Japan. Figure 1 shows the locations of the study area along with the different types of *Porphyra spp.* cultivation areas. The tidal currents sweep into the sea and move northwards along the eastern shoreline and create a counterclockwise water movement [1, 3].

This would sweep the finer suspended particles delivered by rivers on the east side towards the inland end, where sedimentation would occur which was discussed by Ohtsubo et al., (1995).Azad et al., (2005) showed that sediments in the Ariake Sea tidal flats are medium sand to silty mud. Medium sand, which accounts for 71% of the total tidal flats, is located mainly in the east and south coast areas which is discussed by Azad et al., (2005). The study area Iida (33.57º N, 130.40º E), is the most affected by the acid treatment practice. The mud samples at the Iida site gave out a strong unpleasant odor due to the gas-phased hydrogen-sulphide (H_2S).

In the Iida tidal area, an artificial fishing land (40 x 25 m) was created to improve the tidal mud. The mixing of sand and the foamed waste glass with tidal mud was done thoroughly upto 1 meter depth. The quantity of materials in the improvement area was; clay 80% foamed waste glass 15 % and sand 5 %.

Figure 2 shows the cross-section of the improvement area by using sand and the foamed waste glass in the contaminated Iida tidal flat mud. After preparing the improvement area, the baby *Sinonovacula constricta* shells were discharged into the improvement area. The regular monitoring of the geoenvironmental condition of this improvement area was carried out once in every month. A 90 cm long and 7 cm diameter steel tube sampler was used to collect the samples by inserting the tube sampler vertically. The most important geoenvironmental parameter for the benthos life is sulphide content. The sulphide content along with the other geoenvironmental parameters are measured in the pre specified layers. The sulphide content was measured by using the GASTEK 201 H/L methods.

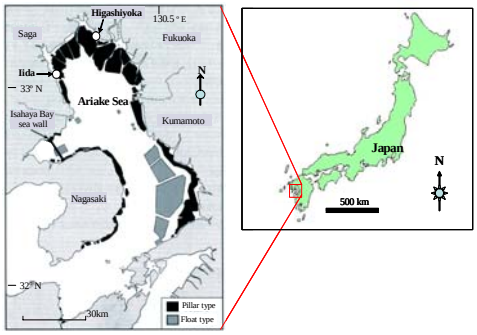
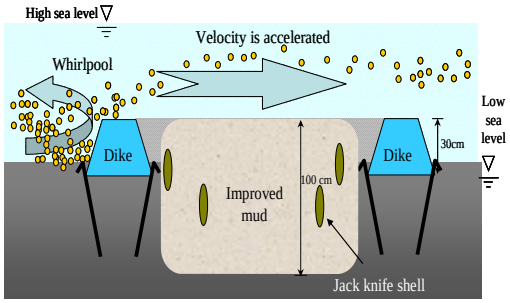


Fig. 1 Map of the Ariake sea

Foamed waste glass which was used in the tidal mud improvement area is a new improved material for improving the geoenvironmental conditions of the contaminated tidal flat. This foamed waste glass has several roles to improve the tidal mud such as increase the permeability of the total mud, decline the sulphide content. Moreover, the continuous void of the foamed waste glass held the gas which increase the time lag and consequently increase the vertical movement of the pore water in the Ariake sea mud.

It is seen that in the improvement area mixing with sand and foamed waste glass, the sulphide content was reduced. The sulphide content was under 0.2 mg/g dry-mud in all the depths in all the seasons. According to the Japanese fisheries research association the safe limit of sulphide content for the various benthoses which are living in the mud is 0.2 mg/g-dry mud.

Fig. 2 Cross-section of improvement area



(artificial fishing land) at Iida tidal Flat

The new recycled waste glass has shown a great effect to improve the unfavorable tidal mud to make it habitable for the benthos living in the tidal mud. The sulphide content of the tidal mud has become reduced for the ease movement of the fresh sea water and also the gas holding capacity of the foamed waste glass. The ample supply of oxygen by these two mechanisms by using the foamed waste glass has helped to minimize the sulphide content and increase the geoenvironmental condition favorable for the benthos.

Resource recovery and the recycle of waste material is a great concern in recent time in all over the world. The recycled waste glass which is known as foamed waste glass has a great use in the construction engineering. But the effective use of this material in the contaminated tidal mud improvement area is quite new. But in the field test in the Ariake sea tidal mud in Japan has proved that the effectiveness of this recycled waste glass material has great influence to improve the geoenvironmental condition of the tidal flat mud. The sulphide content of the improvement area was under the unfavorable range in all the seasons along the depths. The grown-up phenomenon of the *Sinonovacula constricta* has shown that the improvement area is also good place for living and growing of them. In fact, the recycled waste glass (foamed waste glass) can be used as a new improvement material of the contaminated tidal flat mud in an effective way.

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