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Separation of Manganese Nodules from Solid-liquid Mixture Using Hydrocyclone

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ABSTRACT

Manganese nodules are very fragile and easy to be broken to small pieces even to μm or mm size. This can cause environmental problems in the process of a sea test or a commercial mining. For the efficient solid separation from the mixture of sea water and manganese particles, we have performed separation experiments with actual manganese nodules. From the results, it was found that the stages of classification process should be kept to be minimum because the actual manganese nodules tend to be easily broken. For higher efficiency, however, experimental and simulational sensitivity studies for the design and operating variables will be complemented in the next step.

KEY WORDS: hydrocyclone; manganese nodules; separation

INTRODUCTION

For the recovery of useful minerals and the prevention of contamination, appropriate solid/liquid separation processes are needed (Yoon et al., 2004; Park et al, 2005). In a sea test in Korea scheduled in the near future, solid-liquid mixture more than 150 tons per hour should be separated continuously. Because the release of sea water even with small amount of particles can cause environmental problems, a rapid and highly efficient separation method is required to separate solid particles from the sea water. In the previous study(Park et al., 2005), we tried to test the applicability of a hydrocyclone to separate solid-liquid mixture by a CFD model.

Hydrocyclone is the device that is widely used for the separation of materials normally in the form of solid particles (Wang et al., 1999; Yang et al., 2004; Zhao and Jiang, 2005). The device can offer effective solid removal in a compact package comparing with other methods. The suspended solids are separated from the liquid due to the centrifugal force induced inside the hydrocyclone. It has been used in many fields like dewatering of oil or gas and medicine liquid extraction from organic materials as well as liquid separation from solid materials (Cullivan et al., 2004;Yang et al., 2004).

For the development of the lifting technology and actual field pilot mining test, deep-ocean mining project of Korea can be classified as three stages by research progress.

Since 2003, the researches on the lifting technology of KIGAM have entered a new phase of second. From the results of the preliminary small-scale experiments and the developed hydraulic pumping model, we designed an enlarged test system on the 30 m scale. The enlarged experimental system of hydraulic lifting has been set up at the lifting test lab. Also, for the preparation of offshore sea-test, experimental study on manganese separation has been performed. In this study, firstly, the idea of solid-separation will be presented and then experimental result with actual manganese nodules will be discussed.

APPLICATION OF HYDROCYCLONE ON SEPARATION OF MANGANESE NODULES

The flow sheet of a cyclone including sieve band was given as Fig. 1.

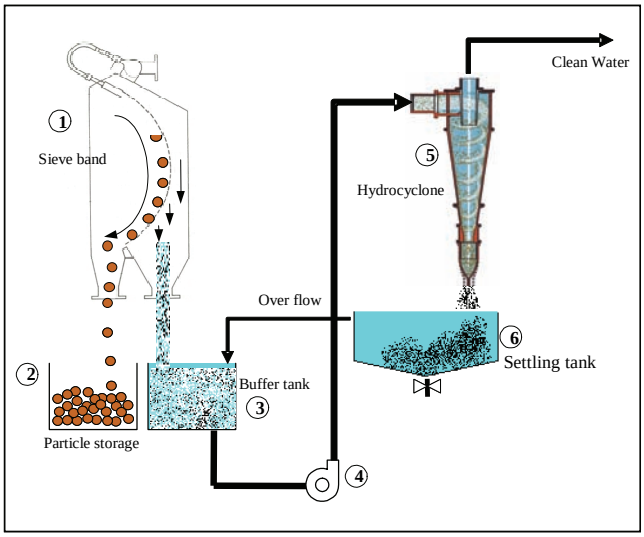

Fig. 1. Schematic diagram of manganese separation using hydrocyclone.