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Concentrated and Gastight Sampler of Deep-sea Microplankton

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ABSTRACT

A sampler of deep-sea microplankton with function of *in situ* concentrated sampling and gastight sampling is proposed and introduced in detail. *In situ* concentrated sampling technique is realized as follows, a microplankton membrane is used as filtration membrane, and a deep-sea pump is used to pump seawater. The microplankton will be captured and the density of microplankton will be increased when seawater flow through the filtration membrane. Gastight sampling technique is realized as follows, a precharged accumulator is used as pressure compensator. During the process of lifting the sampler, the accumulator will compensate the pressure drop continuously. Calculation results showed that the pressure compensation results is relates with the accumulator's volume and precharge pressure.Laboratory experiment results showed that with *in situ* flow through technique, *in situ* concentrated sampling can be realized and maximum concentration ratio was great than 500. With pressure compensation technique based on accumulator, gastight sampling can be realized. Deep-sea experiment results at 1 900m showed that the sampler can realize *in situ* concentrated sampling and gastight sampling.

KEY WORDS: Concentrated sampling; gastight sampling; sampler; deep-sea microplankton.

INTRODUCTION

Deep-sea microplankton is a kind of new deep-sea resource discovered lately. They live in deepsea of several thousands meters and can survive and multiply in conditions of strong acid or strong base, low temperature, high salt and high pressure (Li, 2004; Chen, 2004). Scientific research results show that deep-sea microplankton have many important characteristics. They can decompose petroleum, which can be applied in environment protection (Jiang, 2000). They has important role in deep-sea gas hydrate forming (Xiao, 1998). They may be the constructor of deep-sea manganese nodule and can abstract valent metal from manganese nodule and polymetallic nodule (Hu, 1999). Compared with land microplankton, they may have different metabolize way and heredity background (Xi, 2004).

Research of deep-sea microplankton can help us finding out the origin of earth being, discovering new gene and developing new medicine. America, Japan and some European countries have studied on deep-sea microplankton for decades and many deep-sea microplankton samplers have been produced (Bianchi, 1999; Jacobs, 2002; Dimeo, 1999). For the density of deep-sea microplankton is very low and the sampling depth is several thousands meters, there some limitations on traditional samplers, such as the sampler can only obtained small samples with single sampling and the samples can't keep its original pressure.

A new type of deep-sea microplankton sampler is proposed in this paper, which can obtain large quantity of samples with single sampling and keep the samples with its original pressure.

STRUCTURES AND WORKING PRINCIPLE

The structure of *in situ* concentrated and gastight sampler of deep-sea microplankton is shown in Fig. 1. The sampler is composed of pump, filter membrane, sampling vessel, accumulator, check valve, solenoid check valve and manometer. The pump is used for pumping seawater flow through filter membrane. The filter membrane is used for capturing deep-sea microplankton. The sampling vessel is used for sample storage. The check valve and solenoid check valve are used for closing the sampling vessel when sampling is over. The accumulator is used for pressure compensation. The controller is used for ON/OFF control of the pump and the solenoid check valve.

The working principle of the sampler is following: the sampling vessel is filled with distilled water and the accumulator is precharged with N_2 before sampling. The sampling depth is preset in the controller. During the falling process of the sampler, the controller will check environmental pressure real-time. When the sampler reaches the set sampling position, the controller will generate a trigger to start the pump and the solenoid check valve. With the control of the flow-through time, sampling with fixed concentration ratio will be available. When the sampling process is over, the controller will shut the pump and the solenoid check valve. During the lifting process of the sampler, the environmental pressure will decrease and the volume of the sampling vessel will increase, which will cause pressure drop of the