Preliminary observation on a nitrogen and phosphorus removal system in a small closed circulated seawater aquarium

Wenjun Lou, Weiqing Deng and Shuting Yang
Shanghai Ocean Aquarium
(No.1388, Lujiazui Ring Road, Pudong New Area, Shanghai, 200120, China)
Email：lab@sh-soa.com; tina_yang@sh-soa.com0

Abstract

A nitrogen and phosphorous removal system was designed and installed in a small closed circulated sea water aquarium (V=40L). After a closed circulation for 36 days, it was found that concentration of the nitrogen and phosphorus of the water in the tanks declined from 44 ppm and 22 ppm at the beginning down into 10 ppm and 5 ppm respectively, with a removal rate of the nitrogen and phosphorus as high as 88% and 95% respectively. During the experiment, a mass of Polyp bacteria and many species of indicator organisms were observed through microscopes, such as Scuticociliatida , Daphnia , Aeolosoma , and Vorticella , which suggested that the system had been become mature and stable and taken into effect.

Steps of biologically removing nitrogen and phosphorous

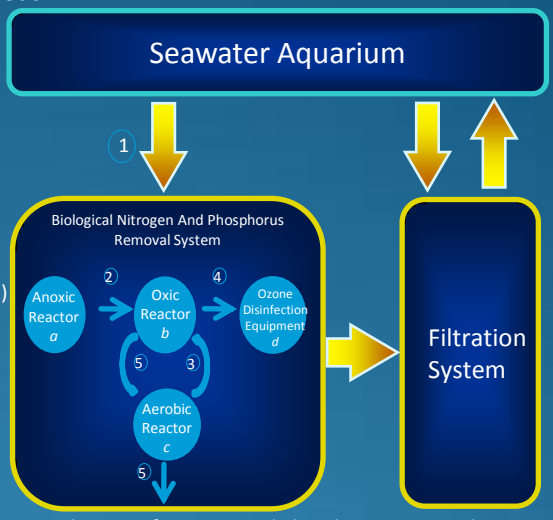
①Seawater was transferred to the anoxic reactor (a) for denitrification.

②After being denitritficated, the water was transferred into the aerobic reactor (b) for aeration and the DO was kept no less than 4 mg/L.

③At the same time, PolyP Bacteria was accumulated in the cultered tank from the aerobic reactor (c) to the aerobic reactor (b) to absorb phosphorus by using the ability of PolyP Bacteria absorbing phosphorus in the aerobic condition.

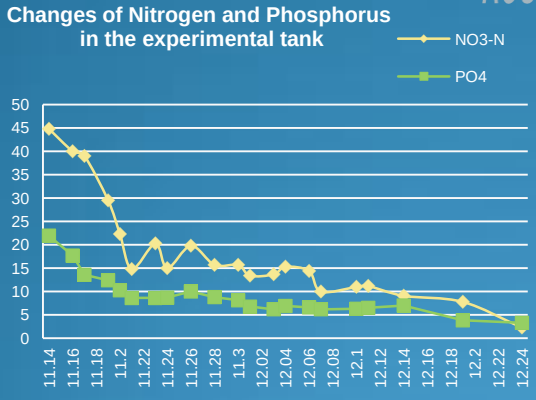
④When the concentration of $PO4^{3-}$ in the water in aerobic reactor (b) grew up to about 1 ppm, which takes about 6 hours, aeration was stopped. Then, after allowing PolyP Bacteria to settle for 30 min, the supernatant of the water in aerobic reactor (b) was transferred to the ozone disinfection equipment for sterilization.

⑤Part of the settled PolyP Bacteria were collected and put back to aerobic reactor (c) to be reused. The others were discharged together with phosphorus.



Schematic diagram of Nitrogen and Phosphorous Removal System

Results



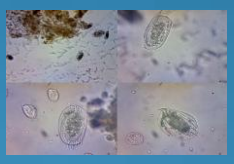


Fig. 1 Scuticociliatida

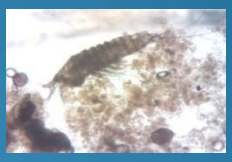


Fig. 2 Daphnia

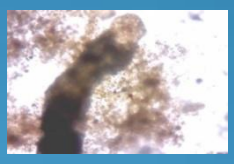


Fig.3 Aeolosoma

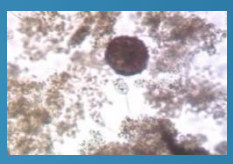


Fig.4 Vorticella

Change of the concentration of the Nitrogen and Phosphorus

After processing for 36 days, it was observed that concentration of the nitrogen and phosphorus in the water declined from 44 ppm and 22 ppm at the beginning to 10 ppm and 5 ppm respectively, with a removal rate of the nitrogen and phosphorus as high as 88% and 95% respectively.

Indicator organisms

During the experiment, a mass of PolyP bacteria and many species of indicator organism were observed through microscope, such as Scuticociliatida (Fig.1), Daphnia (Fig.2), Aeolosoma (Fig.3) and Vorticella (Fig.4), which suggested that the system had become mature and stable and taken into effect.