Development of a high performance ammonia removal system by using a novel marine bacterium

Yasushi Sugano, Mitsuyo Hirai, and Makoto Shoda

Chemical Resources Laboratory,
Tokyo Institute of Technology

Summary

Ammonia is a toxic and fouling gas. Therefore, ammonia removal from several environments, such as exhaust gas from fertilizer plants or garbage composting plants, is important. So far, several biodeodorization treatments to remove ammonia have been reported. Although autotrophic bacteria have been often used to construct ammonia removal system, it is difficult to prevent the contamination of other organisms as the growth rate is very slow compared with general heterotrophic bacteria. Therefore, in this study, we propose a novel system to remove ammonia using *Vibrio alginolyticus* Oiso-1, which is a heterotrophic and halophilic bacterium. In our previous study, we have already presented that this strain decreased the risk of contamination and increased ammonia removal capacity supplying glucose or sucrose as a carbon source. In this work, we focused two pending queries. One was how ammonia was converted. The other was to estimate the possibility of molasses as a cheap carbon source. When 1000 ppm of ammonia was loaded to a bubbling system with Oiso-1 for 7 days, the 90% of loaded nitrogen was remained in the supernatant of the culture. We identified alanine from the supernatant by the analyses of amino acid composition, Thin Layer Chromatography, ^{1}H-NMR and ^{13}C-NMR. This result reveals that ammonia removal by Oiso-1 does not depend on a general nitrification process but a novel ammonia removal process. When molasses was used as a carbon source and various concentration of ammonia (200-1000 ppm) were loaded to a bio-filter column with Oiso-1, more than 80% of ammonia was removed. The complete and maximum ammonia removal capacities were estimated to be 16.5 and 18.7 g-N/kg-dry-Fuyolite/day, respectively. The maximum removal capacity was four times as much as that of autotrophic bacteria. Therefore, Oiso-1 was clarified as a promising ammonia removal method for practical use. It is further important to evaluate the scaled-up ammonia removal system as a future work.