A novel method of treating high-salinity nitrogenous wastewater

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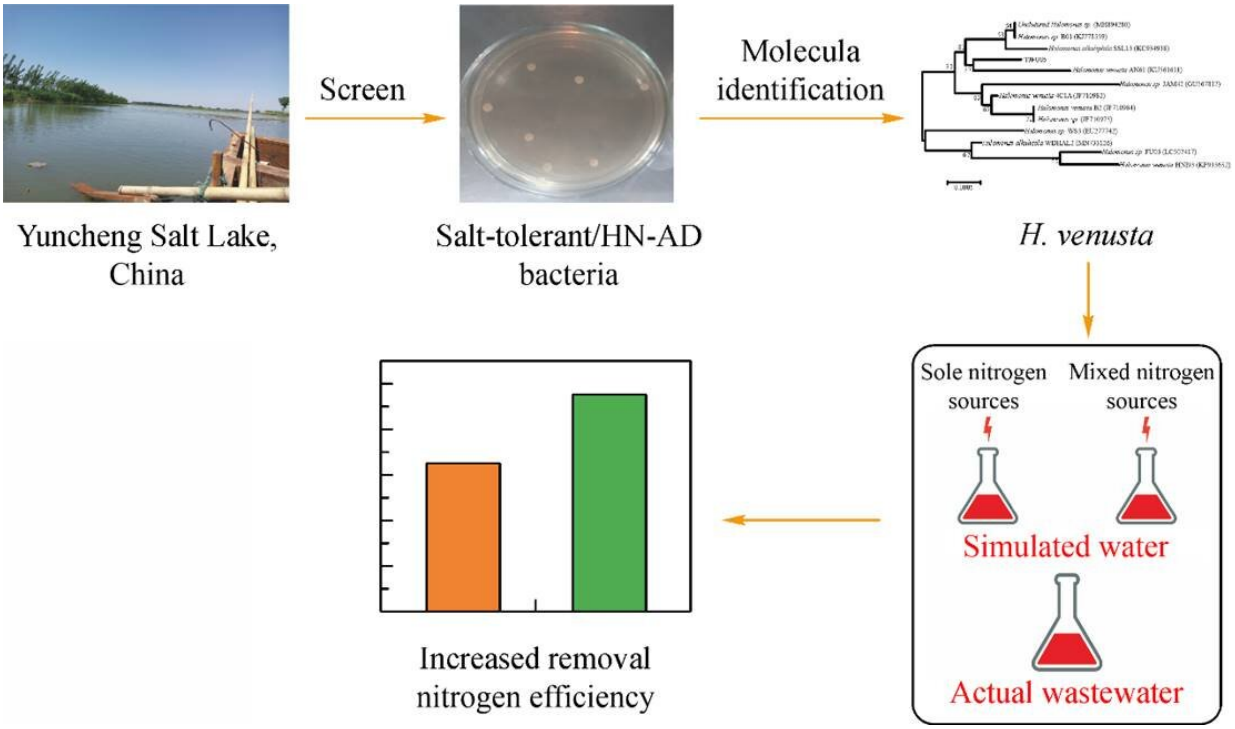

Credit: Quanli Man, Peilian Zhang, Weiqi Huang, Qing Zhu, Xiaoling He, Dongsheng Wei

Nitrogen in hypersaline wastewater produced by industry represents a severe threat to the aqueous environment, and the accumulation of ammonia nitrogen often results in excessive multiplication of algae and leads to decrease of dissolved oxygen and the death of higher organisms.

Meanwhile, the nitrite and nitrosamine in water serious threat to health and life safety of human, animal and microbes. Accordingly, the removal of nitrogen from high-salinity wastewater is a priority.

The bacteria capable of Heterotrophic nitrification and aerobic denitrification (HN-AD) not only provides an excellent solution for the removal of nitrogen from wastewater, but also saves the floor space and operation costs of a sewage treatment plant. However, some HN-AD bacteria are not suitable for hypersaline environments, and reported salt-tolerant bacteria only show considerable nitrification ability but low denitrification ability under high-salinity conditions and are not appropriate for high-nitrogen concentration. Therefore, how do we deal with the wastewater containing high salinity and nitrogen concentration before discharging it into environment?

To address this problem, Prof. He from Tiangong University, Prof. Wei from Nankai University, Dr. Man Tiangong University and their team members have systematically investigated the nitrogen removal performance of H. venusta TJPU05 isolated from the sediment of Salt Lake in simulated water with sole or mixed nitrogen sources and in actual wastewater with high concentration of salt and nitrogen. Their work not only demonstrated the H. venusta TJPU05 processes excellent potential in treating high-salinity nitrogenous wastewater, but also provides a promising microorganism resource for denitrification from hypersaline wastewater with high nitrogen. This study entitled "A heterotrophic nitrification-aerobic denitrification bacterium Halomonas venusta TJPU05 suitable for nitrogen removal from high-salinity wastewater" is published online in *Frontiers of Environmental Science & Engineering* .

In this study, the research team isolated a novel salt-tolerant HN-AD bacterium, Halomonas venusta TJPU05, from the sediment of Salt Lake, which showed excellent HN-AD ability in simulated water (SW) and

actual wastewater (AW) with high concentration of salt and nitrogen. They concluded that 86.12% of NH_4^+-N, 95.68% of NO_3^--N, 100% of NO_2^--N and 84.57% of total nitrogen (TN) could be removed from SW with sole nitrogen sources within 24 h at the utmost. And H. venusta TJPU05 could maximally remove 84.06% of NH_4^+-N, 92.33% of NO_3^--N, 92.9% of NO_2^--N and 77.73% of TN from SW with mixed nitrogen source when the salinity was above 8%. The application of H. venusta TJPU05 in treating AW with high salt and high ammonia nitrogen resulted in removal efficiencies of 50.96%, 47.28% and 43.19% for NH_4^+-N, NO_3^--N and TN respectively without any optimization. Furthermore, the highest activities of ammonia oxygenase, hydroxylamine oxidase, nitrate reductase and nitrite reductase enzymes were obtained at the salinity of 5% and 8%, respectively.

This study isolated a novel salt-tolerant heterotrophic nitrification and aerobic denitrification bacterium H. venusta TJPU05 and demonstrated the H. venusta TJPU05 has enormous potential in treating high-salinity nitrogenous wastewater. At the same time, this research provides a very promising microorganism resource in the field of removal of nitrogen from hypersaline actual wastewater.

More information: Quanli Man et al, A heterotrophic nitrification-aerobic denitrification bacterium Halomonas venusta TJPU05 suitable for nitrogen removal from high-salinity wastewater, *Frontiers of Environmental Science & Engineering* (2021). DOI: 10.1007/s11783-021-1503-6

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