Improvement of Pantoea sp. Denitrification Activity at Low Temperature Using Carbon Sources

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Aquaculture wastewater with high nitrite concentration due to low denitrification activity in winter is lethal to hydrobionts such as fish and shrimp. Therefore, bioremediation using bacteria is one of the most powerful methods. Unlike commercial probiotics, Pantoea sp. grows well at 22°C while its denitrification activity is low. Our data shows that temperature and nitrite affect initial transport rate and cellular metabolism. When ammonium was absorbed by zeolite by about 60%, the denitrification activity was increased by 138%. Addition of 0.1% alpha-ketoglutarate, the denitrification activity was increased by 70%. Western blotting and enzyme activity analyses were shown malate dehydrogenase (MDH) is higher expressions at low temperatures and without nitrite. Monosaccharides and disaccharides can improve denitrification activity at 22°C by six and three times, respectively. The method of addition of carbon source is suitable for 0-3.5% salinity. Lastly, we developed the low-cost amplification culture method in the field. The results of cultured water and aquaria studies show that this method is useful for applicability. Our results were first demonstrated that MDH expression is regulated by nitrite and temperature. Furthermore, our results suggest that carbon sources improve the denitrification activity through regulation of the TCA cycle. Using the amplification culture of Pantoea sp. is more eco-friendly than other methods since it won’t lead to land subsidence and can surely improve the water quality to solve the current aquaculture problem in winter.

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