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APPLICATION OF NITRIFYING BACTERIA AS AN INDIRECT APPROACH TO REDUCE STRESS OF TRANSPORTED ZEBRAFISH

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Abstract

Deterioration of water quality mainly due to the accumulation of fish metabolic wastes, including ammonia, during transport in closed containers can cause severe stress to fish. This is a major welfare issue, particularly for ornamental fish that are traded in large numbers. It is therefore important to keep the water quality in check, so as to reduce the stress associated with transport. During the present study we have examined if the nitrifying bacteria can function as novel bioremediation agents to lessen the harmful effects of ammonia accumulated during transport. For this purpose firstly we applied two commercial nitrifying bacterial consortia in the transport systems to understand their capacities to reduce the accumulating ammonia. The efficacy of nitrification process was evaluated based on the water quality parameters and the community structures of ammonia oxidizing bacteria (AOB). Secondly we applied the most efficient nitrifying bacterial consortia from above in the transport systems and study its effect on reducing the stress of transporting fish. Primary (cortisol) and secondary (glucose) stress responses as well as representative molecular markers of stress- genes involved in hypothalamic-pituitary-interrenal (HPI) stress axis (*crf*, *star* and *11β hydroxylase*) and corticosteroid signaling (*gr*) of fish prior to and after transport were assessed.

Application of nitrifying bacterial consortia significantly improved the nitrifying activity that facilitated the removal of the ammonia accumulated in live fish transport systems. The diverse AOB populations observed were related to the difference in nitrifying activity. At the end of the 72h transport, the primary and secondary stress indicators were lower in fish that were transported with nitrifying bacterial consortia, demonstrating the efficacy of these microorganisms in indirectly reducing transport-associated stress. However, the expression of key genes involved in the HPI stress axis (*crf*, *star* and *11β hydroxylase*) did not correlate with the stress indicators. Our data suggests that improved water quality achieved through bioremediation could alleviate the stress of zebrafish occurring from transport.