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sciforum-091406: Optimizing the dissolved oxygen requirements for effective pollutant removal from coastal aquaculture wastewater aiming at water recycling

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Wastewater treatment presents a pressing global challenge, emphasizing the urgent need for more sustainable solutions. In pursuit of energy and carbon neutrality, microalgal–bacterial granular sludge (MBGS) systems have emerged as a promising alternative, leveraging the symbiotic relationship between the microalgae and bacteria within the granules in terms of gas exchange. MBGS systems offer efficient treatment but also hold promise for substantial energy savings and greenhouse gas emission reductions.

The present study aimed to ascertain the dissolved oxygen threshold required for efficient pollutant removal from coastal aquaculture, aiming at water recycling in industrial settings. To accomplish this, an MBGS system was applied to the treatment of aquaculture wastewater and underwent a gradual reduction in the airflow rate from 3.0 to 1.5 L min^{-1} over 134 days. Regardless of the airflow rate, complete ammonium removal was consistently achieved, while lower airflow rates appeared to enhance nitrite and nitrate removal. The composition of the treated effluents met the toxicity limits for fish, enabling water reuse in aquaculture facilities. However, if the airflow rate was reduced to about 1.5 L min^{-1}, outgrowth of filamentous microorganisms started to occur on the granules' surface, compromising their efficient separation from the treated water.

Aeration typically contributes significantly to the energy consumption in wastewater treatment processes. Utilizing MBGS systems can effectively reduce the aeration needs, up to a certain level, without compromising the treatment performance, thus improving the ecological footprint of the treatment process.

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