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"Gheorghe Asachi" Technical University of Iasi, Romania

P25
BIOREMEDIATION WITH PROBIOTICS IN SHRIMP FARMING

E. Mayer[1], E.M. Gössl[2], G.A. Santos[1], M. Mohnl[1]

[1]BIOMIN Holding GmbH, Industriestrasse 21, A-3130 Herzogenburg; [2]BIOMIN Research Center, Technopark 1, A-3430 Tulln

Abstract

Intensive aquaculture produces large amounts of organic wastes. Oxidation of these waste compounds facilitates the formation of toxic metabolites (H_2S, NH_3, NO_2^-) causing deteriorated water quality. This also changes bacterial composition in water and soil of ponds, increasing the presence of pathogenic bacteria, thus contributing to the occurrence of diseases in shrimp.
The application of beneficial bacteria, probiotics and biodegrading microorganisms, to the pond water and soil (bioremediation) is a sustainable approach to minimize the environmental impact of aquaculture.
NH_4^+- or NO_3^--removal processes (nitrification and denitrification) are essential for the pond water quality and can be carried out by nitrifying or denitrifying bacteria such as *Nitrobacter*, *Thiobacillus* and *Paracoccus*. The aim of the studies was to show that the strain *Paracoccus pantotrophus* (PP) 768 is able to reduce undesirable waste compounds and has a positive impact on pond soil quality.
An *in vitro* study was conducted to test the biodegrading effect of *PP* 768 in two media: an aerobic buffer with 1 g/L yeast extract and 1 g/L sodium acetate as an additional carbon source, and without sodium acetate. The results showed that the heterotrophic *PP* 768 strain impaired the nitrogen cycle by using NO_3^- and other oxidized nitrogen compounds instead of oxygen and drastically reduced the amount of nitrogen compounds. The strain was able to degrade almost the total amount of 60 mg/L NO_3^- in the test solutions within 24 hours. Furthermore, sodium acetate in the medium led to decrease of 16 mg/L NH_4^+ to 7 mg/L within 48 hours.
A field study using a commercial probiotic product (2 x 10^9 CFU/g) containing the strain *PP* 768 was conducted during intensive farming of white shrimp (*Litopenaeus vannamei*) to test the effects on soil quality under practical pond conditions. The trial was carried out for a period of 57 days with a dosage of 600 g/ha of product applied every 5 days. It has been confirmed that the ponds using bacterial strains showed better soil conditions (yellow soil) compared to the control ponds (black soil) and enhanced shrimp performance parameters. Average daily growth of shrimp in the probiotic treatment was improved by 36 % and FCR by 9 % when compared to the control.
It has been shown that *Paracoccus* is able to control the above mentioned processes.