

Development of a Bioprocess Technology for the Production of *Vibrio midae*, a Probiotic for Use in Abalone Aquaculture

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Abstract : The abalone industry of South Africa is under severe pressure due to illegal harvesting and poaching of this seafood delicacy. These abalones are harvested excessively; as a result, these animals do not have a chance to replace themselves in their habitats, ensuing in a drastic decrease in natural stocks of abalone. Abalone has an extremely slow growth rate and takes approximately four years to reach a size that is market acceptable; therefore, it was imperative to investigate methods to boost the overall growth rate and immunity of the animal. The University of Cape Town (UCT) began to research, which resulted in the isolation of two microorganisms, a yeast isolate *Debaryomyces hansenii* and a bacterial isolate *Vibrio midae*, from the gut of the abalone and characterised them for their probiotic abilities. This work resulted in an internationally competitive concept technology that was patented. The next stage of research was to develop a suitable bioprocess to enable commercial production. Numerous steps were taken to develop an efficient production process for *V. midae*, one of the isolates found by UCT. The initial stages of research involved the development of a stable and robust inoculum and the optimization of physiological growth parameters such as temperature and pH. A range of temperature and pH conditions were evaluated, and data obtained revealed an optimum growth temperature of 30°C and a pH of 6.5. Once these critical growth parameters were established further media optimization studies were performed. Corn steep liquor (CSL) and high test molasses (HTM) were selected as suitable alternatives to more expensive, conventionally used growth medium additives. The optimization of CSL (6.4 g.l⁻¹) and HTM (24 g.l⁻¹) concentrations in the growth medium resulted in a 180% increase in cell concentration, a 5716-fold increase in cell productivity and a 97.2% decrease in the material cost of production in comparison to conventional growth conditions and parameters used at the onset of the study. In addition, a stable market-ready liquid probiotic product, encompassing the viable but not culturable (VBNC) state of *Vibrio midae* cells, was developed during the downstream processing aspect of the study. The demonstration of this technology at a full manufacturing scale has further enhanced the attractiveness and commercial feasibility of this production process.

Keywords : probiotics, abalone aquaculture, bioprocess technology, manufacturing scale technology development

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