

Microbial populations causing off-flavour in recirculated aquaculture systems

Mie Bech Lukassen^{1*}, Edward Schramm², and Jeppe Lund Nielsen¹

*Corresponding author: Mie Bech Lukassen, e-mail: mbl@bio.aau.dk

¹ Aalborg University, Department of Chemistry and Bioscience, Fredrik Bajers Vej 7H, 9220 Aalborg, Denmark

² IMARES Wageningen UR, Haringkade 1, 1976CP IJMUIDEN, the Netherlands

Abstract

Microbial production of geosmin, a secondary metabolite with an earthy off-flavour is a serious economic problem in wine production, drinking water and aquaculture. Geosmin is produced by a small group of bacteria all harboring the geosmin synthetase gene (*geoA*).

Sequencing and analyzing the distribution of *geoA* in more than 50 European and Brazilian aquaculture systems has allowed us to identify the diversity among geosmin-producing bacteria. The different populations of geosmin-producers were evaluated relative to plant design, environmental and operational parameters in full-scale aquaculture systems using multivariate statistics. The influencing parameters identified were subsequently validated by testing their gene expressions in well-controlled pilot scale aquaculture systems.

The results show that the *geoA* gene is a relative well-conserved gene with limited horizontal gene transfer events and are found in at least six phylogenetic groups covering 0.1% of the total community with only a minor fraction being culturable.

Quantification of *geoA* within recirculated aquaculture systems reveals that geosmin-producing bacteria are more abundant in the water treatment compartments compared to the water phase. Furthermore, the gene expressions of the individual groups show positive correlations to the organic loading and presence of oxygen.

The current study reveals the presence of important populations involved in geosmin production and which parameters are of importance for their presence and activity. These findings are useful for the future optimization and management of full-scale aquaculture plants, and can be used as a diagnostic tool in developing strategies to limit the presence and growth of geosmin-producing bacteria.