Eutrophication-threatened aquatic ecosystems: sediment biogeochemical processes towards nutrients control


1 IBB – Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal.
2 Department of Chemical Engineering, Tokyo University of Agriculture and Technology, Naka-cho, Koganei-shi 184-8588 Tokyo, Japan.

Keywords: Eutrophication; sediment bacterial community; water quality modelling

Eutrophication of surface water bodies results mainly from anthropogenic activities occurring in their watersheds. Nutrient loads from intensive fertilization and livestock are a major problem, particularly during intense precipitation, due to the transport of nutrients through the watershed ionic system into downstream water bodies (Martins et al., 2008). Nowadays, eutrophication is also due to internal inputs of phosphorus (P), as is the case of Azoreans lakes (Ribeiro et al., 2008). Sediments are sites of intense microbial activity fostered by the presence of several organic and inorganic electron donors and acceptors that can be metabolised either under oxic or anaerobic conditions (Martins et al., 2010). Nevertheless, little attention has been paid to the sediment microbial community. In that regard, the present work aims to characterise the sediment microbial community, as well as the geochemical profiles towards the control of nutrients flux between sediments and water column. This work was carried out using as a study model, the volcanic lakes Verde, Azul, Fogo and Furnas (Azores, Portugal).

Geochemical profiles from lake Verde sediments presented high organic matter – OM (20 ± 2 %), total phosphorus – TP (2.10 ± 0.08 mgP/gDW), total nitrogen – TN (1.31 ± 0.50 mgN/gDW), and total iron - TFe (8.06 ± 0.13 mgFe/gDW) concentrations in the uppermost sediment layer (1 cm), and decreasing concentrations with sediment depth. Profiles from lake Azul (OM ~12 ± 1 %, TP ~0.77 ± 0.02 mgP/gDW, TN ~10 ± 1 %, TP ~0.81 ± 0.05 mgP/gDW, TFe ~3.78 ± 0.26 mgFe/gDW) and lake Furnas (OM ~10 ± 1 %, TP ~0.81 ± 0.05 mgP/gDW, TN ~0.23 ± 0.12 mgN/gDW and TFe ~4.52 ± 0.31 mgFe/gDW) were quite homogeneous in depth. The distribution of phosphorus fractions in the different sediment layers was fairly homogeneous and the highest amounts of P (71 %) were bounded to metal oxides (25 %) and incorporated into biomass and detritus (46 %).

Besides, dominant members of the sediment bacterial community, investigated by denaturing gradient gel electrophoresis and cloning of the bacterial 16S RNA gene fragment, were mostly affiliated to Proteobacteria (Alpha-, Delta-, and Gamma-

References

