

IN-SITU MONITORING OF PHYTOPLANKTON ON THE CELL LEVEL

George B.J. Dubelaar

CytoBuoy b.v., Weijland 70 C, Nieuwerbrug 2415BD, The Netherlands

Biographical Sketch of Author

George Dubelaar has been involved in the design of dedicated phytoplankton flow cytometers since 1985, starting with the 'Optical Plankton Analyzer' and subsequently the 'EurOPA' for the large range of cell and colony sizes found in coastal zone and fresh water phytoplankton. In 1995, he initiated the EC supported CytoBuoy Project to further develop this technology for routine, autonomous and in situ (buoy based) operation. Author is now CEO of CytoBuoy b.v. which was founded in 2001 to continue the development, production and support of in-situ flow cytometers.

Abstract

Although phytoplankton is of fundamental importance in aquatic ecosystems, continuous and high frequency time series of their abundance and composition in surface water are difficult to sustain and rarely available. We have designed an in-situ instrument to analyse and count phytoplankton on the cell level, for autonomous, online operation with remote control and data acquisition. This instrument, called CytoBuoy, uses the flow cytometry principle, originally developed to analyse blood cells in the biomedical field.

An important feature of flow cytometers is that they analyze all detectable particles in a small volume of water in a one by one sequence, acquiring light scatter and fluorescence properties of each cell as it flows through a focussed laser beam. The flow through system makes it inherently fast, whereas the one-by-one principle yields accurate results without bias or relying on a priori assumptions on particle properties. In addition to this, the CytoBuoy instruments perform length and shape determinations of each particle. Particle concentrations are directly obtained, while the correlated data allow statistical analyses, size classification and discrimination between main phytoplankton groups and other particles.

Besides the traditional use in the laboratory, CytoBuoy instruments can be used autonomously "in-line", on board of a ship measuring from a continuous seawater supply or as a vertical profiling instrument, or as a buoy based instrument, and even on a submarine. Several CytoBuoy instruments are in use now. The results from fixed monitoring stations, buoy and various ships trials, including a Korean ferry and the UK AutoSub underwater vehicle show that operational and long term monitoring of phytoplankton on the cell level is feasible now.