DOC 411-002

Triathler in studies for marine ecology

Key words: C-14, radioactive bicarbonate, phytoplankton

Primary production at Baltic sea: Assimilation of ^{14}bicarbonate by phytoplankton

Triathler was employed for studies in marine ecology on m/s Aranda, the research ship owned by Finnish Institute of Marine Research, during a routine summer expedition (July 1997) on Baltic Sea to monitor water quality and biological parameters. The instrument was used for quantification of 14C-bicarbonate uptake by phytoplankton, a step needed for determination of primary production.

Principle

An essential step in determining primary production of algal phytoplankton is its uptake of radioactive bicarbonate (NaH14CO3). The method shortly outlined below is in use on m/s Aranda.

Water samples containing phytoplankton algae are collected from selected depth levels and a small amount of each sample is incubated with radiolabel in a constant illumination incubator. The algae then assimilate 14C-bicarbonate solution. The samples are filtered and the radioactivity accumulated in algae trapped on filter is determined by liquid scintillation (LS) counting. From the carbon dioxide concentration of water and the obtained radioactivity value, the primary production of phytoplankton can subsequently be calculated.

Procedure

The measurement was performed at the marine site coded as Station LL7 (59°50'98N 24°50'01E). Water was sampled from the depths of 1, 2.5, 5, 7.5, 10, 15 and 20 m. Immediately, water from the sampling flasks was poured into primary production flasks by filling them and 100 *l (2 *Ci) of NaH14CO3 was added. The dark flasks (depths of 0, 10 and 20 m) were wrapped into a black neutral density filter foil to prevent light from reaching them. Because of darkness, no assimilation should take place in them.

All flasks were incubated in constant standardized illumination for 2 hours. The temperature was set to the average temperature of the productive layer (0-10 m).

Immediately after incubation samples were filtered through cellulose acetate filter discs (pore size 0.45 *m, diameter 25 mm) by applying under pressure. The discs were then inserted into empty scintillation vials and, in order to remove inorganic radiocarbon as carbon dioxide, 0.1 ml of 0.5 N HCl was added and vials were let stand for half an hour with caps open. Finally, 10 ml of scintillation cocktail was added, vials were capped and counted

Results

The results as Triathler's Excel sheet are shown in the attached appendix. The shaded area contains the original output data. The main result is also summarized in the table below. The letter "L" indicates incubation in light, and the letter "D" incubation in dark (wrapped in neutral density filter foil), respectively. The 14C counting window was set to 35 - 950 to maximize efficiency. Each sample was counted with two 60 s repeats to see possible drifts. The instrument background (10 ml of cocktail) was near 45 CPM. For comparison, the table also includes data from a standard LS counter 1219 Rackbeta (Wallac).

Table 1 Assimilation of $NaH^{14}CO_3$ by phytoplankton

Sample (depth)	Triathler CPM	1219 CPM
1m L	628	731
2.5m L	600	714
5m L	682	793
7.5m L	715	823
10m L	527	644
15m L	220	244
20m L	107	105
0m D	72	66
10m D	62	54
20m D	59	50

Conclusion:

Triathler's counting efficiency was well comparable with that of a standard LS counter in this work. Samples were also found to be of constant quench so that DPM conversion, if required, can be done by simply setting an appropriate factor. As a light-weight, portable and economical instrument, Triathler makes an attractive tool in marine studies.