

EXPERIMENTAL INVESTIGATIONS ON TRITIUM INCORPORATION INTO THE MARINE GREEN ALGA *ACETABULARIA ACETABULUM*

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ABSTRACT

The unicellular marine alga *Acetabularia acetabulum* L. (Silva), *Dasycladaceae*, is a useful organism to study the impact of tritium on the aquatic environment. The plant is capable of converting HTO to OBT, under light as well as under dark conditions, although to a lower extent. *Acetabularia* actively incorporates supplied amino acids (H^3 -leucine) into cell and chloroplast proteins, having molecular weights ranging from 140 to 12 kdaltons. HT/HTO and HT/OBT conversion is under investigation.

1. INTRODUCTION

Recent work suggested that in fusion reactor facilities and in recovery systems, tritium inventories could attain very high values (10^{10} Ci or 3.7 EBq) (Peterman et al., 1985). The possibility, thus, exists that workers shall be exposed to high concentrations of tritium gas (HT or T₂). Oxidation of HT to HTO and incorporation of tritium into organic materials (OBT) could provoke a contamination of the foodchains leading to man. This last aspect is of particular importance since OBT in human foods could increase the total body dose by a factor of 1.7-4.5 times the free body water dose alone (Travis, 1985).

Tritium may be taken up by aquatic organisms, directly from the surrounding water (HTO, dissolved tritiated organic molecules or HT), or indirectly through contaminated foods. Micro- and macro-algae are of particular interest for investigations on the behaviour of tritium in the aquatic environment. In previous studies (Bonotto et al., 1982; Arapis et al., 1984a,b), we have shown that tritium, supplied as tritiated water, was incorporated into the organic matter of various green algae. This paper deals with the incorporation of tritium supplied to *Acetabularia*, under light and/or dark conditions, in different chemical forms (tritiated water, tritiated amino acids and tritium gas).

2. RESULTS AND DISCUSSION

When vegetative *Acetabularia* cells are supplied with HTO ($10 \mu\text{Ci/ml}$ or 3.7×10^5 Bq/ml) during 7 days, tritium is incorporated into their organic matter. Microcombustion analyses have shown that under dark conditions the amount of organic tritium (OBT) present in the cells is lower than that fixed under light conditions by a factor of about 4. Nevertheless, it is of interest to notice that HTO/OBT conversion occurs even in darkness.

Tritiated leucine ($1 \mu\text{Ci}$ or 3.7×10^4 Bq/ml) was taken up at a higher rate under light than under dark conditions. At the end of the experiments (24 h), however, the uptake of H^3 -leucine in darkness was reduced only by about 20%. The ratio between acid soluble and acid insoluble tritiated compounds, after a 5 h incubation period, was respectively 1.8 and 2.4 in light and in darkness. The incorporation of tritium from tritiated water (HTO) or from tritiated leucine (OBT), into the proteins of whole and/or isolated chloroplasts (labeled *in vivo*), was studied also by electrophoresis on 15% polyacrylamide gels. Protein markers were used to determine the approximate molecular weight of the tritiated molecules. The gels were sliced and counted, as reported before (Arapis et al., 1984b), or submitted to autoradiography (Kodak X-Ray Ortho G Film, using a fluorographic procedure). Labeled proteins had molecular weights ranging from 140 to 12 kdaltons in whole cells as well as in chloroplasts. Since very recent work has shown that algal chloroplasts (*Chlamydomonas reinhardtii*) have an hydrogenase activity (Majone and Gibbs, 1986), the incorporation of tritium gas into *Acetabularia* (one cell contains about 10 millions of chloroplasts) is being studied.

3. ACKNOWLEDGEMENTS

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IMPACT OF LAND-BASED SOURCES ON CHROMIUM SPECIES AND CONCENTRATIONS IN COASTAL WATERS WEST OF ALEXANDRIA

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Nothing is known about chromium levels in Egyptian waters, its speciation and input from land-based sources, and very little from the Mediterranean basin(1). The present study aims at assessing the relative proportions of Cr III, Cr VI and particulate Cr in the sources and in coastal waters (Mex Bay) at 20 stations occupied during two successive cruises. Samples were pumped out from surface and bottom layers and kept in acid-washed PVC containers. All the precautionary recommendations of Kremling(2) were followed. Filtration was carried out on acid pre-cleaned Nuclepore filters (0.4 μm). Co-precipitation / AAS procedure was followed to distinguish between Cr III and Cr VI.(2&3) Flameless AAS was applied using a double-beam Perkin-Elmer AAS. Analysis of 15 replicates gave a coefficient of variation of 7%. The rates of input are given in table 1 and the distributions in figure 2.1-2.2. The total average concentrations and the relative proportions of the three forms in coastal waters and in the sources are illustrated on figure 1. Cr in all forms, decreased slightly seaward but the decrease was more pronounced for particulate Cr. The concentrations in coastal waters ranged from 0.09 to 7.11 $\mu\text{g/L}^{-1}$ (particulate), 0.005 to 1.37 $\mu\text{g/L}^{-1}$ (Cr III) and from 0.03 to 3.01 $\mu\text{g/L}^{-1}$ (Cr VI). The relatively low proportion (11%) of Cr III in sea water is likely to be caused by oxidation to Cr III, by adsorption followed by precipitation.

The input of the tanneries effluent however is mainly in the form of Cr III (chromium sulfate) while the particulate form is dominant in the other effluents. The proportion of Cr VI increases rapidly offshore, the particulate form remaining dominant.

References:

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Table (1): Average daily discharge of Cr from the main effluents west of Alexandria (kg day^{-1}) (n = 6).

Cr species	Tanneries effluent	Kayet Bey pumping station drain	Urban
partic.	36.66	26.40	324
diss. Cr ⁶⁺	7.32	7.50	87
diss. Cr ³⁺	174.36	3.30	65
Total	220.32	37.20	456

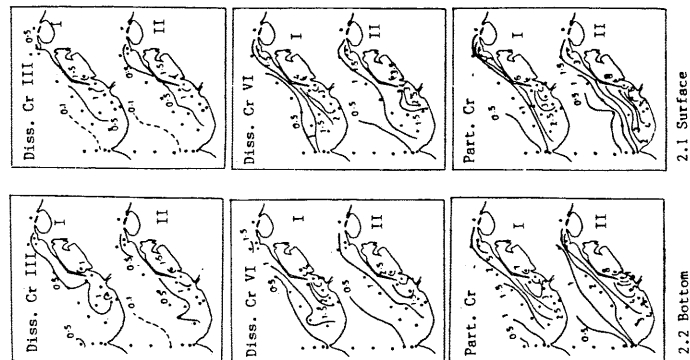
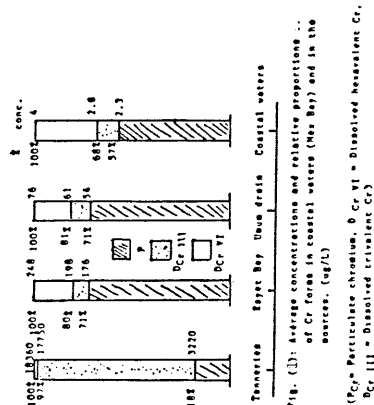


Fig. (2.1)-(2.2): Horizontal distribution of Cr ($\mu\text{g/L}^{-1}$) in surface and bottom waters (I: May, II August)