METHOD OF CONCENTRATING PARTICULATE MATTER FROM SEAWATER FOR RADIOACTIVITY MEASUREMENTS

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As is well known, artificial radioisotopes are found in the sea not only as ions in solution, but also as organic and inorganic particulate matter. The radioactivity of these particles is difficult to distinguish from that of dissolved substances.

The aim of this research was to find a method for the collection from seawater of particles ranging from 1 to 20 microns, which are easily lost with very fine plankton nets. The amounts had to be sufficient for a gamma-activity spectrum measurement and for biological and chemical analysis. This is not possible with the usual procedures (APHA, AWWA, WPCF, 1960; KREY, 1961), especially in seawater from oligotrophic pelagic zones.

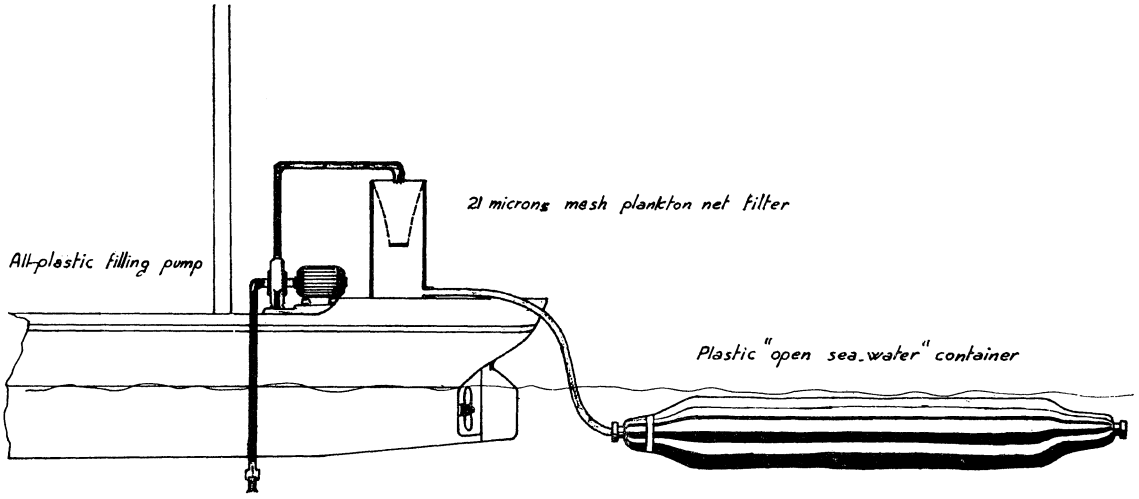

FIG. 1. — *Scheme of the collection of seawater at sea.*

The use of columns of calcium carbonate powder as a filtering agent has the following advantages over that of membrane filters :

1) the filters are not easily clogged, because the filtered particles are distributed in a layer 2-3 millimetres thick; large volumes of water can therefore be filtered;

2) the top layer of calcium carbonate can be easily removed and dissolved in EDTA solution, the particulate matter being suspended in a small volume from which it can be recovered by centrifuging.

The columns used were 220 millimetres high and 110 millimetres in diameter; they were half-filled with marble powder (5 000 meshes/cm^2). On top of this first layer was deposited a second one, 12-14 mm thick, of very fine calcium carbonate powder, reagent grade (C. ERBA,

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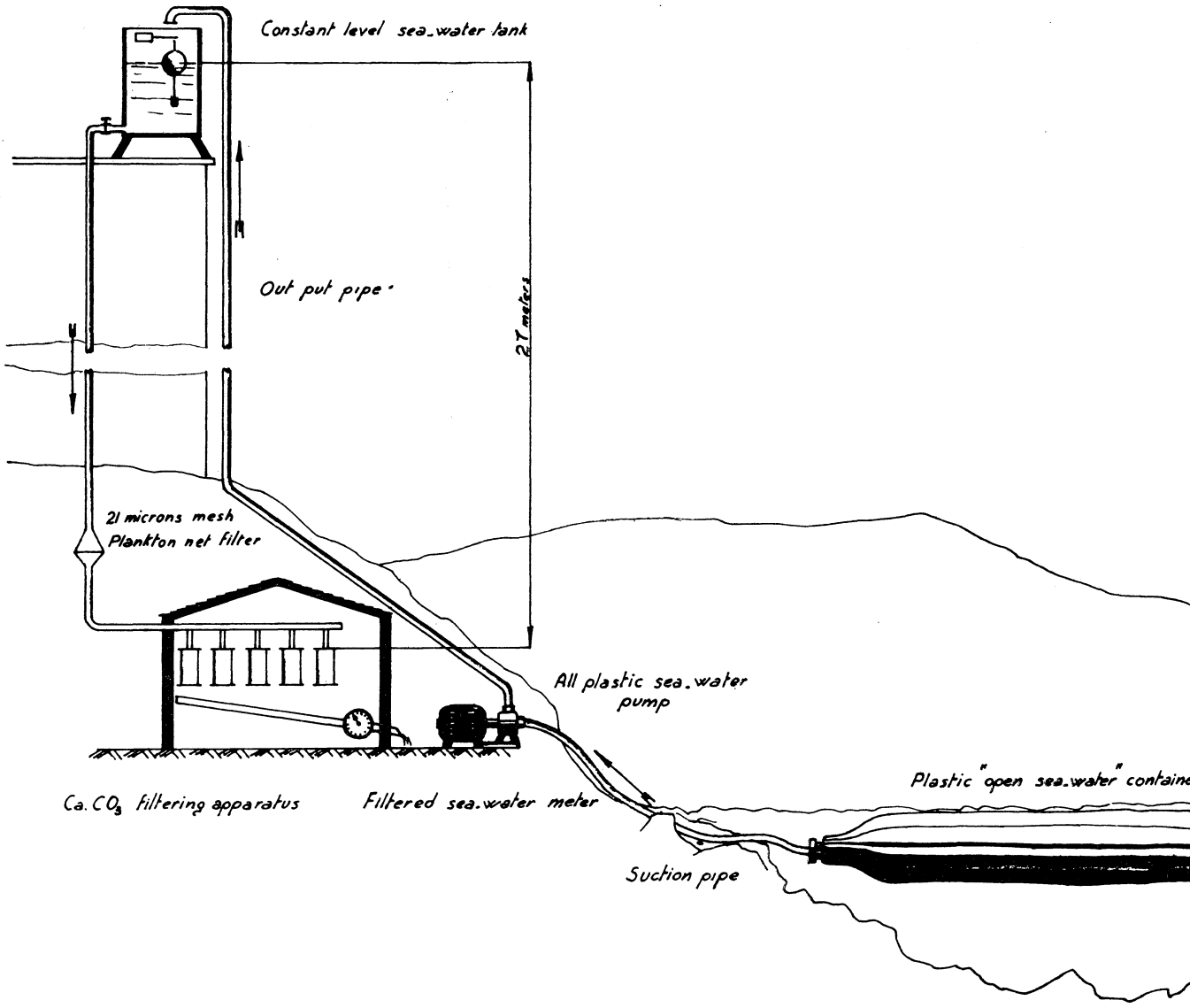

FIG. 2. — *Scheme of filtration of seawater for enrichment of particulate matter.*

Milan). The efficiency of the filtration columns was tested with a marine bacterium, *Serratia marinorubra* (0.5 × 1.0 microns), and with spores of *Bacillus subtilis* (0.6 × 1.1 microns).

These tests revealed that 80 % of the organisms remain in the uppermost layer and are able to grow after EDTA treatment (disodium salt 0.16 M + NaCl 0.34 M).

From these results it can be concluded that the filters efficiently retain particles larger than 1 micron. Owing to the very low particulate matter content of the sea-water used (from the pelagic Ligurian Sea), it was necessary to filter very large quantities i.e. from 1 to 10 thousand litres. To bring such large quantities of seawater on land use was made of large plastic bags which were enclosed in sailcloth and had capacities of 1 000 to 10 000 litres. The bags were filled at sea with water filtered through a plankton net and were then towed to the shore and anchored in the bay near the laboratory (fig. 1).

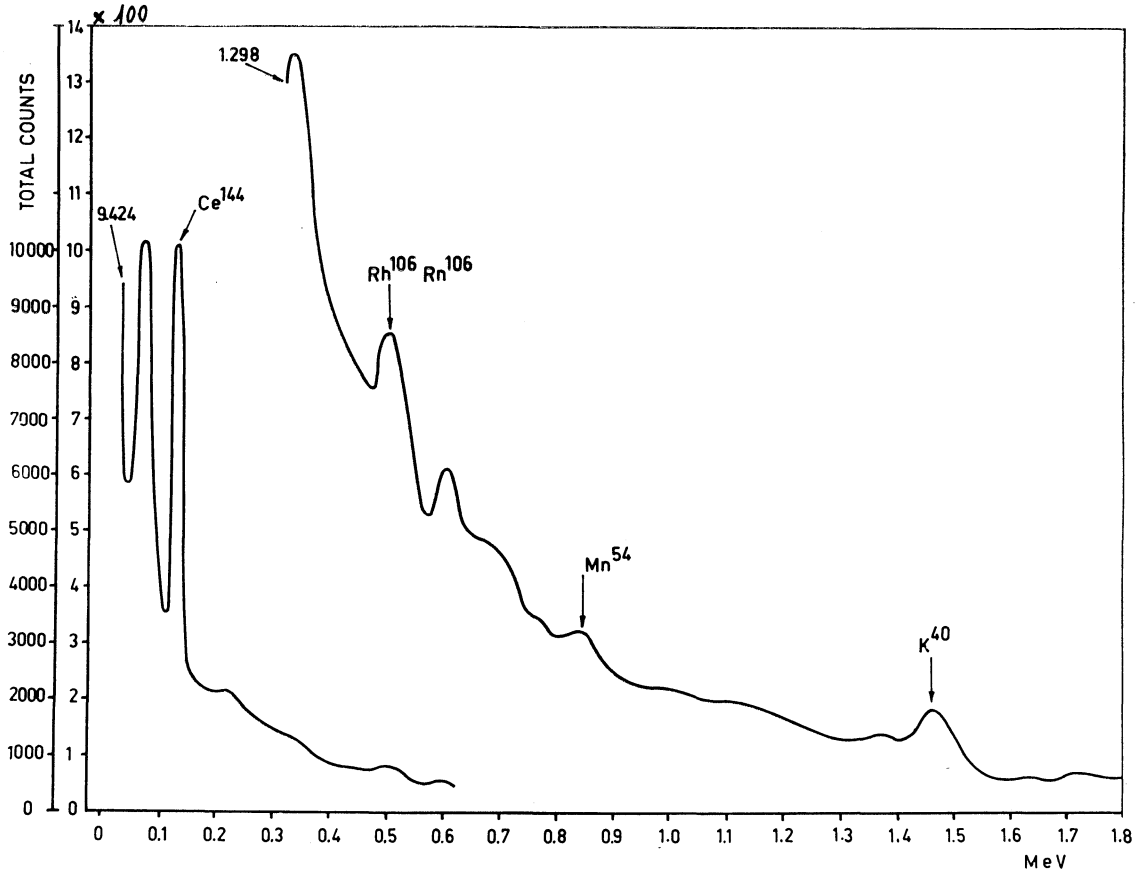

FIG. 3. — *γ-spectrum of particulate matter before dissolving calcium carbonate with EDTA.*

In order to have a constant filtering pressure the water was pumped, with an all-plastic pump and pipes, to the roof of the laboratory and filtered through the columns at a pressure of 2.5 kg/cm², the filtered water volume being measured with a water meter (fig. 2). Batteries of 6 columns were used, each column having a filtration capacity of 300-500 litres. The results of three experiments are shown in table 1.

A gamma-spectrum of the sample of 30 September 1964 was obtained before dissolution with EDTA by courtesy of Dr. F. GIORCELLI, Laboratorio per lo studio della radioattività ambientale, C.N.E.N. Casaccia, Rome) (fig. 3).

The gamma-activity of the calcium carbonate filtration agent was measured under the same conditions.

Date	Volume filtered	Dry weight	Mg/l
2.IX.63	390	160	0.32
30.IX.64	3 000	536	0.18
3.X.64	430	108	0.25

TABL. 1. — *Results of experiments on the filtration of seawater.*

Only the radioisotope quantitatively detectable is Ce^{144} in quantities of 0.1 picocurie per litre of filtered seawater. After dissoluting of the calcium carbonate containing the filtrated particulate matter and recovery of this material by centrifuging, the Ce^{144} activity is not detectable. This can be due to one of the following causes :

1) the Ce^{144} is not in particulate form, but is adsorbed on the filtering medium;

2) the radioisotope is in particulate form, but is dissolved by the EDTA.

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