HANDLING OF RADIOACTIVE LIQUID WASTE

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INTRODUCTION

For the decontamination of radioactive liquid wastes and extraction of radionuclides, we propose the "foam separation" method. Studied and illustrated in a previous paper (1), this method has a high efficiency, in very dilute solution, in those cases where traditional methods meet with economic and practical limitations. For many years, in both chemical and nuclear applications, the "foam separation" method has been used with success.

The proposed method permits the selective extration of only one ion or the extension of the extraction to a large spectrum of ions. Moreover, the extracted ions are concentrated in extremely small volumes (the reduction of total volume of treated liquid is about 1/1000).

EXTRACTION TECHNIQUES

In order to effect extraction, for solutions containing various ions in very low concentrations, it is sufficient to introduce a surfactant, a substance capable of adsorbing such ions at the liquid-air interface. A stream of gas passed through the liquid causes the surfactant to foam: the foam thus formed is the technical means which permits the collection of this mono-layered liquid.

The efficiency of estraction by means of foam separation is conditioned by numerous parameters, among which the most important are: the pH value and the surfactant concentration.

EQUIPMENT AND RESULTS.

The basic equipment required is very simple: Fig. 1 (1).
For extraction with recycling: Fig.2 (2).
Some results obtained employing the "foam separation" method are reported in Table 1.

RISKS-BENFITS AND CONCLUSIONS

The final destination of low-level radioactive liquid wastes is the acquatic environment; this involves negatives effects to the ecologic system.

There exist, as above mentioned, studies to establish either acceptable limits within which such discharges can be carried out, or dilution processes. In any case, in a hydrobiological system, radionuclides can at first be dispersed in surface waters. From these, through suspended materials, sediments, acquatic plants and animals, the radionuclides can be transmitted to the terrestrial environment and to man. For example, figure 3 (3) reports the ways through which radioactive substances dispersed in deep water

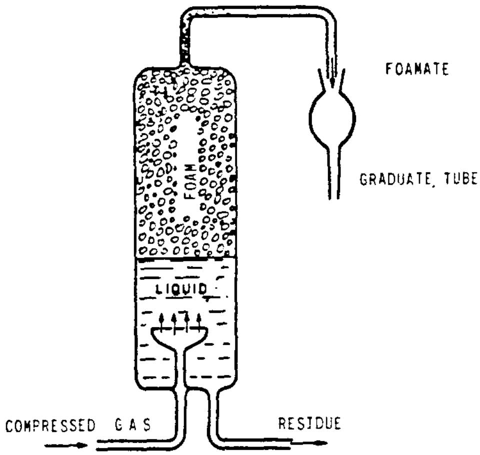

Fig. 1(1) Schematic diagram of a single stage apparatus

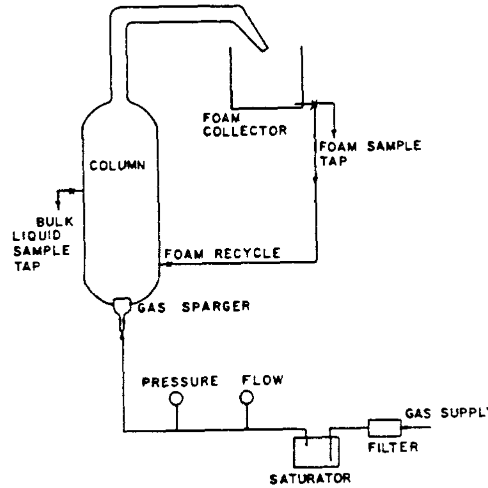

Fig.2. Schematic apparatus of Schnepf *et al.* (2). The mechanical foam breaker, not visible in the picture, is mounted in the collector.

Fig 3(3). *Simplified diagram snowing the ways in which radioactive substances dispersed in ground waters or surface waters (ocean included) reach man. (1) radioactive substance; (2) direct radiation; (3) air; (4) aquatic plants; (5) sand and sediments; (6) fishing vessels and leisure facilities; (7) surface or ground waters; (8) aquatic animal; (9) man; (10) irrigation water; (11) radioactive substances; (12) land plants; (13) ground; (14) land animals; (15) ingestion.*

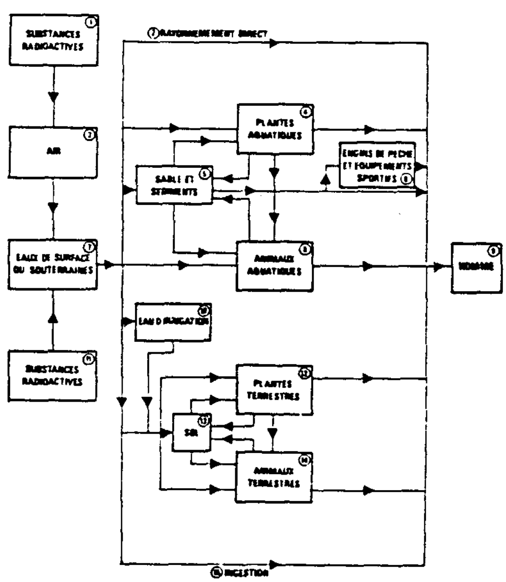

Table 1. Some results obtained employing the "foam separation" method.

Ions	Surfactant	Extraction %	Reference
^{90}Sr	Sodium salt of dodecylbenzyl-diethylene-triamine tetraacetic acid (DBDTTA)	99	4
^{144}Ce		98	
^{137}Cs		10-20	
^{95}Zr	By precipitation in $Fe(OH)_3$ e $Co(OH)_2$, and floated using sodium oleate		5-6
^{95}Nb	- when a single operation was used	98	
^{106}Ru	- with four successive flotation on the same solution	90	
^{106}Rh			
^{141}Ce			
Zn^{2+} ^{65}Zn (as tracers)	dodecylimino-dipropionic acid (Deriphat 160)	92	7
Ca^{2+} ^{45}Ca (as tracers)		99	
Sr^{2+} ^{89}Sr (as tracers)		91	
Ba^{2+} ^{139}Ba (as tracers)		95	
Cr^{6+}	sodium dodecylsuphate after reduction to Cr^{3+}	97	8
Pb^{2+}	sodium lauryl suphate	99	9
Cd^{2+}	4-dodecyldiethylenetriamine	98-99	10

(including oceans) or in surface waters can reach man.

It is indispensable therefore to try as much as possible to reduce the level of pollution by treating the waste effluents prior to discharge into the acquatic environment.

The technique proposed and implemented by us, as previously mentioned, resolves, perhaps entirely, the problem.Infact, most of the methods currently used for the treatment of radioactive liquid wastes have the strong disadvantage of eliminating one pollutant by the employment of another pollutant.

Our method, instead, produces none or very small quantities, of wastes. Therefore, the benefits to be derived are evident.

The potential utility of the "foam separation" method arises from technical and economic feasibility.

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