Disposition of Radioactive Organic Scintillation Solvents by Incineration

V. 1 Disposition of Radioactive Organic Scintillation Solvents by Incineration

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Introduction

By the amendment of the law concerning the treatment of radioactive organic scintillation solvents in 1980, we become to be able to incinerate radioactive organic scintillation solvents, if the following two conditions are fulfilled. The first condition is that the solvent should contain only ^{3}H or ^{14}C and not the other RI, and the second condition is that the concentration of the activity should not exceed $37Bq/cm^3$ (1×10^{-3} $\mu Ci/cm^3$).

We constructed an incineration facility in which an incinerator made by Wakaidarigaku Co. Ltd. was installed. We began to incinerate the solvents since May 1984. We made some improvements in the incinerator. Here we describe about them.

Incinerator

Fig. 1 shows the diagram of the incinerator. Scintillation solvent is pumped up from the reservoir tank ① to the first distillation chamber ③. In this chamber the solvent components which evaporated at relatively low temperature are distilled out and go up to the combustion chamber ⑥ and burn there. On the other hand, the components which do not evaporate in the first distillation chamber flow down to the second distillation chamber ④ and is heated there sufficiently to be distilled or cracked completely and to be flow up to the combustion chamber.

The burned gases and evaporated water are cooled in the condenser ⑧. Water vapor contains ^{3}H is condensed into water and collected in the drain tank ⑩. Carbon dioxide which contains ^{14}C is exhausted from the stack into air.

On constructing the facility, we ordered the maker that a washing solution tank ⑪ should be equipped beside the reservoir tank. In this tank fresh and clean organic solvent is reserved, and after incineration of waste solvents this organic solvent is burned for about 20 minutes to clean the interior of the incinerator.

Troubles and improvements

Some troubles are encountered in operating the incinerator and the improvements we made are as follows.

(1) It was found that solid materials often precipitated in the bottom of the first distillation chamber during combustion. Paper chromatography cleared that the precipitates were composed of PPO. Scintillation solvents contain usually about 0.7% of PPO and the precipitates of PPO were deposited in the first distillation chamber. We searched for liquids which could dissolve the PPO precipitation and transport them to the second distillation chamber and itself be easily burned. The results are shown in Table 1. It was found that glycerin was the most effective and cheap solution and that precipitation of PPO was prevented by adding 1% glycerin in the waste solution.

(2) A stirrer was introduced in the reservoir tank. The waste liquid is apt to separate into phases and this tendency is accelerated by adding glycerin. If the liquid which has two or more phases is burned, burning conditions become unstable. By stirring, combustion became very stable.

(3) Carbon adhered to the second burner. The second burner had a tendency to be choked up with carbon after about 20 liters of waste liquid were burned. Therefore, we had to clean it once a day. It was a troublesome matter. We found the burner was cleaned by burning kerosene. Kerosene burns at a higher temperature than waste liquid and the carbon adhered to the burner changed to carbon dioxide.

By introducing, in addition, a few minor improvements in the incinerator, we have already burned about 300 liters of radioactive organic scintillation solvents without trouble.

Table 1. Effect of additive solvent.

Solvent	Concentration (%)				
	0.2	0.5	1.0	2.0	5.0
Glycerin	-	-+	+	+	+
Ethylene Glycol			-	-+	+
Ethyl Cellosolve				-	
Diffusion pump oil				-	-
Kerosene				-	-

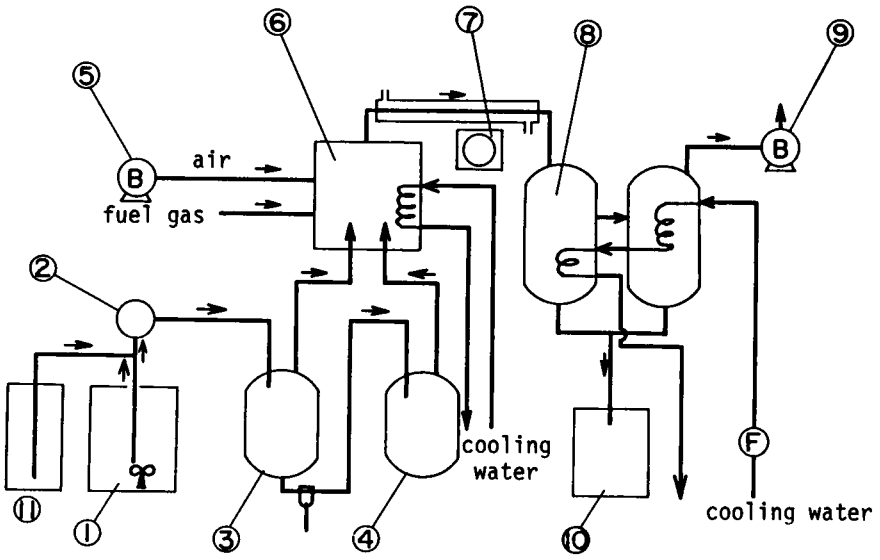

Fig. 1. Diagram of incinerator.
① reservoir tank, ② pump, ③ first distillation chamber, ④ second distillation chamber, ⑤ air compressor, ⑥ combustion chamber, ⑦ ventilation fan, ⑧ condenser, ⑨ blower, ⑩ drain tank, ⑪ washing solution tank.