ANTIFOAM AND EVAPORATORS

Introduction

Quite a number of engineer officers have shown interest in the various reports which have appeared recently in the press and in technical publications on the application of antifoams to distilling plants. The following remarks attempt to describe what this compound does, and how useful it is likely to be, in helping to get the best out of Service distilling plants.

The possible advantages in employing an antifoam in evaporators were brought to the notice of E.-in-C. by the Admiralty Materials Laboratory, where a series of pilot plant trials were carried out on various different substances to obtain a preliminary assessment and to establish dosage rates. This work was followed by trials at the Admiralty Distilling Experimental Station on full-scale plants, and now an aircraft carrier, cruiser and destroyer are carrying out trials at sea.

What Antifoam Does

The antifoam being used in these trials is one of the polyethylene glycols. In order to obtain the full effect of the material, quantities as low as 0.0005 per cent by weight of sea-water feed are required. In the various trials which are being carried out at the Admiralty Materials Laboratory, the Admiralty Distilling Experimental Station and in various ships in commission, the antifoam has been injected with Admiralty evaporator compound. The quantities of antifoam required are too small to inject separately and it has been found convenient to mix it with evaporator compound during manufacture.

In a normal evaporator the ebullition level is maintained just up to the top coil for maximum output without priming. This method of running ensures that all coils are doing some useful work, although the top coil is only intermittently submerged in foam and splashings from the body of the brine. The coils immediately below the top coil are submerged in foam of varying 'denseness'. The more dense the foam becomes, the greater will be the heat transfer from coil to brine for given steam and brine temperatures.

If antifoam is suddenly added to the feed of a running evaporator, the ebullition appears to die down and the brine level in the shell falls by twelve to eighteen inches, uncovering the top three of four coils. This is because the antifoam has greatly reduced the surface tension of the bubbles of steam formed on the coil surface, so that they are released before they can grow to any appreciable size. The brine in the shell is thus more 'dense'. If the brine level is now raised to cover all the coils it will be apparent that, for the same coil area, it will be possible to obtain a greater heat transfer rate. It should not, of course, be assumed that this greater heat transfer will be obtained for the same steam consumption. In fact, the steam consumption will rise proportionately to the heat transfer. However, it should mean that, provided the necessary quantity of steam is available, it will be possible to obtain a higher output from any given evaporator.

Difficulties

If full advantage is taken of the increase in the heat transfer rate, it will mean, of course, that the velocity of vapour up the shell and through the baffle is increased. It has been found that, in spite of the great reduction in foaming, these higher velocities do create a tendency to droplet carry-over from the brine surface, into the baffle. This effect can be obviated by reducing shell vacuum to below the 20 in normally used, and therefore, the specific volume of the vapour and the vapour velocity. It is also possible that the higher brine temperature obtained with the lower vacuum makes the antifoam itself more effective. A reduction of shell vacuum much below the normal 20 in is, however, undesirable from the point of view of economy and from the point of view of scale formation.

In a number of naval plants, the combined baffle and splash plate is fitted low down in the shell immediately above the top coil. In some of these plants it has been found that, when the water level is raised to the top coil, there is a tendency to splash brine into the baffle and produce dirty water ; if the water level is lowered sufficiently to ensure clean water, the output is reduced to about that normally produced without antifoam, and the top coils, which are only intermittently covered by splashing, scale up rather more rapidly than is normal.

No distilling plants, fitted in warships, are designed to allow a very great increase on the evaporator capacity with their existing distillers and pumps. The limit on maximum output is, of course, more obvious under tropical conditions. In very few plants will the feed regulators control to the new levels required when antifoam is used.

Current Trials

Because the effectiveness of the antifoam is likely to vary with different designs of distilling plant, it is impracticable to introduce it generally into the Service until it has been adequately tested on a reasonable number of types of installation, particularly as in some cases it may result in a reduction of output. It is intended to continue with trials in various ships in service until there is sufficient information on which to base a realistic assessment. Eventually, if it is considered that its introduction is warranted, it will be introduced as the stocks of the present Admiralty evaporator compound become exhausted. Unfortunately it is uneconomic to reprocess compound to include antifoam, and it is not possible to mix it on board.