AGITATION EFFECT ON THE SEPARATION OF BINARY MIXTURE IN HIGH VACUUM DISTILLATION

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An experiment on distillation of E.H.P.-mT.C.P. system was performed by use of pot still in a range of residual air pressure from 1.0 x 10^{-3} mmHg to 3.5 x 10^{-1} mmHg. The effects of residual air pressure and liquid surface temperature on relative volatility have become clear. The agitation effect on relative volatility was also investigated.

Experiments and Discussion

The experiments were performed by use of the pot still described in the previous paper3). At six residual air pressures (1.0 x 10^{-3} mmHg, 3.5 x 10^{-3} mmHg, 1.0 x 10^{-2} mmHg, 3.5 x 10^{-2} mmHg, 1.0 x 10^{-1} mmHg and 3.5 x 10^{-1} mmHg), the distillation of E.H.P.-mT.C.P. system was performed in the composition range from 30 mole% to 35 mole%. The relative volatility (α) was calculated by Eq.(1).

$$\alpha = \frac{y}{1-x}$$

The effects of liquid surface temperature and residual air pressure on relative volatility

The variation of α with liquid surface temperature is shown in Fig. 1. At constant liquid surface temperature, α increases as residual air pressure is raised. On the other hand, α increases as the liquid surface temperature is lowered at constant residual air pressure.

The agitation effect on relative volatility

The liquid phase in the pot still was agitated by a magnetic stirrer, and the agitation effect on relative volatility was investigated. In this work, the authors could not discover a torpid liquid surface1-4), and we considered that there is no effect of torpidity.

The agitation effect on relative volatility increases as liquid surface temperature is lowered. At high liquid surface temperature, there is no agitation effect on α.

Up to a rotational speed of 300 r.p.m., the value of α increases with rotational speed. But the value of α measured at a rotational speed of 360 r.p.m. was smaller than that measured at 300 r.p.m.. The authors consider that these facts may be explained by the following reasons. Sufficient disorder in liquid phase is not yet obtained at a rotational speed

Received on October 30, 1971

* Received on October 30, 1971

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VOL. 5 NO. 2 1972 (109)
of 240 r.p.m.. On the other hand, the radius of the cylindrically rotating zone (forced vortex zone) and the influence of entrainment increase as the rotational speed increases. At a speed of 360 r.p.m., the value of $\alpha$ was decreased by these influences. Therefore, we obtained the greatest value of $\alpha$ at the rotational speed of 300 r.p.m..

Nomenclature

- $M$ = molecular weight [g/mole]
- $P$ = residual air pressure [mmHg]
- $P_v$ = vapor pressure [mmHg]
- $t$ = liquid surface temperature [°C]
- $x$ = mole fraction of more volatile component in liquid
- $y$ = mole fraction of more volatile component in vapor
- $\alpha$ = relative volatility

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