

Experiments carried out in this Laboratory with a number of fish liver oils seem to indicate that under normal refining conditions just the opposite is the case. The neutralized oil, far from losing anything of its original potency, extracts to a large extent vitamin A from the soap formed during the neutralization, so that the result of the alkali-treatment is increased, and not diminished, potency. In oils with high potency and high acid-value, this increase can be quite substantial, as illustrated by the following example.

A sample of Groper liver oil with 120,000 I.U. of vitamin A per gm., 12.5 per cent free fatty acids and 3.95 per cent impurities² was neutralized with an excess of sodium carbonate, centrifuged and filtered. The results are shown below :

| | Weight (gm.) | Vitamin A potency (I.U. per gm.) | Total content of vitamin A (I.U.) |
|------------------|-----------------|----------------------------------|-----------------------------------|
| Original oil | 24.50 | 120,000 | 2,940,000 |
| Neutralized oil | 18.75 | 140,000 | 2,625,000 |
| Oil in soapstock | 5.75 | 44,000 | 253,000 |
| | (by difference) | | |

The 5.75 gm. of soapstock oil consisted, according to the analysis, of 3.06 gm. fatty acids, 0.97 gm. impurities and 1.72 gm. neutral oil, which latter could be extracted with petrol ether from the soapstock. The potency of this oil can be assumed as 140,000 I.U. per gm., the same as the bulk of the neutralized oil, and consequently 1.72 gm. of it accounts for 240,800 I.U. out of the total of 253,000 I.U. in the soapstock. This leaves for the fatty acids in the form of soap, and for the impurities, 12,200 I.U., or less than 0.5 per cent of the total amount of vitamin A present in the original sample.

The loss of vitamin A during the alkali-refining is, therefore, due mainly to some neutral oil being carried away with the soapstock, while the potency of the neutralized oil has increased. As the latest refining methods allow of a loss closely approaching the theoretical Wesson loss, the amount of trapped neutral oil being reduced to a minimum, it seems now beyond doubt that alkali-refining provides the most economical and simple method of purifying oils containing vitamin A.

It may be added that the alkali-refining of vitaminic oils prior to molecular distillation is covered by a patent³. In the example contained in this patent, there is an indication of increased potency of neutralized oils, inasmuch as 4,600 gm. of pollack liver oil having a vitamin A potency of 10,600 units per gm. (or a total of 48,760,000 units) has yielded 4,285 gm. of refined oil with a vitamin A potency of 12,200 units per gm. (or a total of 52,277,000 units). This increase, however, shown without any explanation, amounts to a net gain of 3,517,000 units of vitamin A produced out of nothing, and, therefore, must be attributed to an experimental error.

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² Estimated by the method of Wesson and Jamieson. Jamieson, G. S., "Vegetable Fats and Oils", 454, 2nd edit.

³ B.P. 526,289 granted to K. C. D. Hickman and Distillation Products, Inc.

Explosive Decomposition of Ethylene Oxide

THE slow decomposition of ethylene oxide vapour has received the attention of a number of investigators¹⁻³. In extension of their work, we have studied the limiting conditions of temperature and pressure under which the reaction becomes explosive in a 550 c.c. quartz bulb.

At 773° K., the presence of nitrogen very slightly raises the minimum ignition pressure, as the following figures show :

| Moles N ₂ added per mole C ₂ H ₄ O | Pressure (partial C ₂ H ₄ O at limit (mm.)) |
|---|---|
| 0 | 90 |
| 0.5 | 91 |
| 1.0 | 93 |

This result suggests that the ignition is of a thermal character and that, in accordance with the weight of opinion regarding the slow decomposition, the reactions leading to ignition do not involve chains. For such a thermal ignition the pressure (p) and temperature (T) at the ignition limit are related, theoretically, by $\log_{10} p/T = A/T + B$, where A and B are functions of the thermal properties of the system and the kinetics of the reaction leading to ignition.

We have traced the p - T explosion limit of ethylene oxide from 90 mm. at 773° K. to 325 mm. at 743° K., and find that between these points the graph of $\log p/T$ against $1/T$ indicates a continual decrease of A and/or B with rising temperature. The most probable explanation is that B is decreasing, thus implying an increase in the order of reaction with increasing temperature, that is, with decreasing pressure. This conclusion is in accordance with the findings of Thompson and Meissner³ with regard to the slow decomposition reaction in the same pressure-range.

Our detailed conclusions on this subject, together with those relating to the flame reactions of ethylene oxide in the presence of oxygen⁴, will be published in due course.

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¹ Heckert, W. W., and Mack, E., *J. Amer. Chem. Soc.*, **51**, 2706 (1929).

² Thompson, H. W., and Meissner, M., *Trans. Farad. Soc.*, **32**, 1451 (1936).

³ Seddon, R. V., and Travers, M. W., *Proc. Roy. Soc., A*, **156**, 234 (1936).

⁴ Cf. Burgoyne, J. H., and Burden, F. A., *Nature*, **162**, 181 (1948).

Stability of Chelate Complexes

ATTENTION has recently been directed to parallels in the order of the stability constants of the complexes formed by bivalent metal ions with different ligands^{1,2}. We have investigated the stability constants of the complexes formed by metal ions with β, β', β'' -triaminotriethylamine, $N(\text{CH}_2\text{CH}_2\text{NH}_2)_3$, (tren), which can provide four ligand atoms for a given ion, as previously shown by Mann and Pope³, who prepared complexes of this tetramine with several bivalent ions. The stability constants have been evaluated by combining the acidity constants of the acid $(\text{trenH}_3)^{3+}$ with the equilibrium constants of the reaction :