SOLUBILITY OF TRICOSANE IN NITROALKANES
AND IN A MIXTURE OF NITROETHANE AND TOLUENE

V. A. Rakhmanova and L. M. Kozlov

Literature data exist on the possibility of using nitroalkanes for the purification and deparaffination of oil fractions [1, 2].

In an investigation of the solubility of various paraffins in C<sub>4</sub>-C<sub>4</sub> nitroalkanes it was established that the lower representatives of the series of nitroalkanes (nitromethane, nitroethane) in their capacity to precipitate paraffins are considerably superior to acetone, which has found wide application as a selective solvent for deparaffination of oils and in the paraffin industry [3]. However, data on the solubility of paraffins in nitroalkanes do not give a complete picture of the solubility. Therefore, the authors have carried out work on the study of the solubility of paraffins in nitroalkanes over a wide range of concentrations and temperatures. In addition, it is well known that the lowest nitroalkanes, like other polar solvents, are not capable of dissolving oils completely since they exhibit selective properties with respect to aromatic hydrocarbons [4, 5].

Consequently, the lower nitroalkanes, like other polar solvents, can be used for deparaffination of oils only in a mixture with other solvents. Therefore, it was important to investigate the solubility of the lowest nitroalkane in a system of paired nitroalkane-toluene solvents. For comparison, an investigation was also made of the solubility of tricosane in the system of solvents acetone-toluene.

To study the solubility, the selected paraffin hydrocarbon was a normal hydrocarbon, i.e., tricosane, with a boiling temperature of 383.8°C and a melting temperature of 47.7°C. The solvents were previously purified nitromethane, nitroethane, 1- and 2-nitropropane, 2-nitrobutane, toluene, and acetone.

The solubility investigations were carried out by the usual method over a wide range of change of the concentrations and the temperatures. The solubility of tricosane in nitroalkanes and the solubility of the corresponding nitroalkanes in tricosane were studied. Investigation of the above five nitroalkane-tricosane systems permitted establishing a general law for the solubility of paraffin hydrocarbons in a number of nitroalkanes.

The data obtained on the solubility of tricosane in C<sub>1</sub>-C<sub>4</sub> nitroalkanes is shown in Figs. 1, 2.

It follows from examination of the diagrams that in all systems with nitroalkanes there is a general law for the solubility of tricosane which had already been observed in investigation of the solubility of paraffins in alcohols, ketones, and acids of the fatty series [6, 7, 8].

Thus, nitromethane and nitroethane, similarly to methyl alcohol, ethyl alcohol, and acetic acid, give a region of stratification of the liquid phases, the main part of which lies above the melting temperature of tricosane. In the nitromethane-tricosane and nitroethane-tricosane systems, this region is particularly broad in view of the small mutual solubility of the lower nitroalkanes and tricosane and occupies the main part of the diagram. In other respects there are no differences in principle. The regions of equilibrium of the liquid phases (see Fig. 1) are represented on the diagram by the areas nfhlm and n'fh'l'm', respectively, which become discontinuous above the temperature of the investigation. The curves dnm'tnt and d'n'm't'mt bound the solid phases of the systems being considered and are crystallization curves. Thus, we have here the saturation curves (turbidity) and the crystallization curve, with the corresponding temperatures t<sub>sat</sub> and t<sub>cryst</sub>. In both cases, within the limits of the compositions between the points n(n') and m(m') to each mixture there correspond two transition temperatures: the turbidity temperature (t<sub>turbid</sub>) and the crystallization temperature (t<sub>cryst</sub>). In addition, the dotted line f1 on the diagram joins...
the equilibrium liquid phases and shows that with the attainment of the corresponding temperature, a separation into two layers will take place in the liquid mixtures. It is characteristic also that crystallization in the sections nm and n'm' takes place mainly along a straight line at a constant temperature.

In the system 1- and 2-nitropropane-tricosane (see Fig. 2) the solubility picture is regular and varies rather considerably. Here, there are also regions of stratification, but they are small and closed, with the presence of the critical points K and K' on the maximum curves. The total mutual solubility of the components in these systems is also considerably higher than in the preceding systems. In the system with 1-nitropropane, the region of liquid stratification is somewhat broader and the upper critical point lies at a higher temperature than in the system with 2-nitropropane. Thus, the region of stratification of the liquid phases reflects the effect of the molecular structure of the solvent on the solubility process. It is also of interest that in systems with 1- and 2-nitropropane, in contrast to systems studied previously, stratification of the phases sets in at temperatures considerably lower than the melting temperature of tricosane. In the system 2-nitrobutane-tricosane no stratification of the liquid phases is observed. We have here a smooth crystallization curve; only in the section n'm' does the rise in the temperature lag slightly. The curve dn'm't recalls the crystallization curve in the methylethyl ketone-paraffin system.