NEW PROCEDURE OF CALCULATION OF NON-STATIONARY PROCESS OF HYDROGEN ISOTOPS SEPARATION BY WATER RECTIFICATION

I. A. Alekseev, O. A. Fedorchenko, V. D. Trenin, V. V. Uborsky[1)]

[1)] *JSC "DOL", Moscow*

Water rectification is of great interest for heavy water wastes reprocessing with the purpose to obtain concentrated heavy water.

The law of non-equilibrium concentrations change on the separation steps in the time, defining the duration of enriched product accumulation is known only for the range of small concentrations [1, 2]. Its application to the wide concentration range leads to considerable errors in defination of time achievement of steady-state concentration (and this time is very often measured by hundreds of hours). The theory, which gave life to this law, is based on some principles, one of which — the principle of concentrations profile similarity — from our point of view, is wrong. It is easy to prove, counting [1–3] at the same time "enriched" and "depleted" parts of the column and trying whithout success to balance the material accounts of the plant.

The mathematical model of nonsteady-state rectification has been created and the computer programme has been made on its base.

Equation of material balance for every step of separation with the balance checking up the whole plant is the main principle of the mathematical model. The system of the differential equations was calculated by numeral methods.

Two modes have been developed: usual "Borya" with the step of integration less than 1 second and unusual "Profile" allowing to work with the step of integration about 1 hour. The first mode is more precise, but it requires considerable computer's time. Comparative calculations of the same variants according to two programmes have shown their sufficiently good coincidense with essentially higher fast-acting programme "Profile". Graphic possibilities of the Turbo-Pascal 5.5 are widely used in the programme. The diagram of concentration dependence in the reboiler and at the top of the plant in a separation process and also the

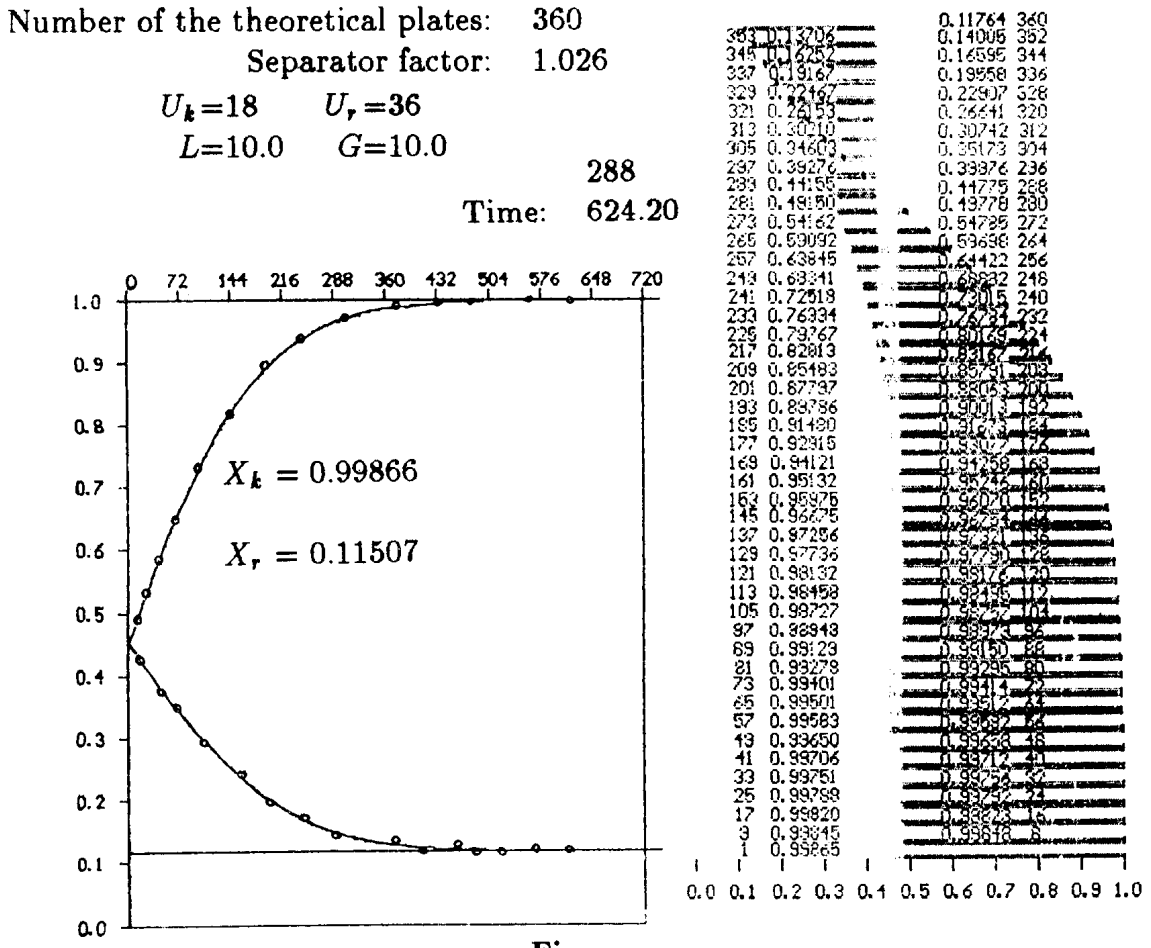

Fig.

profile of concentrations in the column in the calculation process is displayed on the screen of the computer. The print of the screen in the moment the simulation is close to stationary state is shown in figure. Good coincidence with the experiment is clearly seen from the diagram on which the experimental points are marked.

And a few words about an experimental plant of JSC "DOL". The column with diameter 80 mm and height 10 m, is filled with spiralprismatic packing $3\times3\times0.2$ mm made of stainless stell wire [4]. The experiment was carried out on the mixture 45% D_2O + 55% H_2O. The samples of heavy water were analysed by IR-spectrophotometer method with the instrument Specord M80.

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