MODELING OF FLEXIBLE RESOURCE EFFICIENT SYSTEMS OF ISOTOPIC SEPARATION INCLUDING EXCHANGE AND MEMBRANE PROCESSES

V.S. Balashkov, A. Verhun

National Research Tomsk Polytechnic University,

Russia, Tomsk, Lenin Avenue, 30, 634050

E-mail: Balashkov_vit@mail.ru

At present, active research is being carried out in the field of the use of ion exchangers in isotope separation processes. This is connected with the desire to escape from the use of harmful substances in the process of separation. A number of metho ds have been developed that make it possible to achieve an acceptable separation factor. It was also suggested the introduction of flexible production systems (FMS) in isotope separation processes.

To optimize the work of the cascade for the separation of isotopes, as well as accelerate the rate of product renewal, the transition was made from the automation of individual elements of the production process to complex automation at all levels. The use of FMS in countercurrent ion-exchange columns is possible, since they are realized, enrichment in different isotopes with minimal adjustment of equipment.

The use of FMS in industry allows to resolve the contradictions between high productivity and the lack of mobility of equipment for mass production and high mobility and low productivity of universal equipment of single and mass production.

The special feature of FMS is a group flexible re-tunable technology of enrichment process management, a high degree of automation, which ensures minimal human participation in performing direct production functions related to the technological process.

When selecting the ion exchangers for the process under consideration, the method of directed search of systems with the maximum separation properties is used. A computer program has been developed that makes it possible to determine the velocity of the front motion as a function of the current density and the ratio of the studied mobilities of the ions. Calculations are carried out both for monopolar ion exchangers (cations, anions), and for a mixed layer of ion exchangers. The experimental setup implementing this separation method includes a countercurrent exchange column and an electrodialyzer in which phase flows are reversed. For the separation process, organic and inorganic ion exchangers are used. In the column, counter motion of the ion exchanger and solution is carried out. The ion exchanger moves in the column from top to bottom. The speed of its movement can vary within wide limits. The solution is fed to the lower part of the column, in which the counterflow of ion exchanger and solution is carried out. The optimum velocity of ion exchange was 0.04 cm/s. Based on the values of the coefficients of mutual diffusion, the value of the VETS is determined. The calculated values of this value agree with the experimental data. When the isotopes of light alkaline elements are separated, the VETS value is obtained equal to 6 cm, and the degree of separation is 1.45. Based on the obtained results on isotope separation in exchange and electroionic processes, a computer program has been developed for the cascade of separation devices. The program allows you to analyze the work of the cascade in stationary and non-stationary conditions. The influence of fluctuations of the main parameters on the efficiency of the cascade is considered. The program makes it possible to determine the concentration profiles of the nature of the distribution of the fluxes of the separated isotope along the stages of the cascade. The complex of the conducted researches on modeling of the considered processes, the separation of isotope and ionic mixtures on the experimental setup made it possible to draw a conclusion about the adequacy of the mathematical models obtained in the work, to determine the optimal conditions for the separation processes.

The results of the research in this area are the scientific basis for solving the problems of increasing the efficiency of separation processes, searching for new methods for separating and fine-tuning substances, determining the optimal conditions for their conduct, taking into account the requirements of ecology and safety.

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PROFILING OF NUCLEAR POWER PLANTS

Oddi Cristofer Addo

National Research Tomsk Polytechnic University,

Russia, Tomsk, Lenin Avenue, 30, 634050

Nuclear Power Plants (NPP) comprises of components working together to generate heat energy for different applications including generation of electricity, production of radioactive isotopes and heating of homes. Studies are constantly done to improve reactor performance through better utilization and longer fuel cycle length. There are several factors which affect the performance of the reactor core including fuel enrichment, use of burnable absorbers, height of insertion of control rods and moderator design. These factors affect reactivity in different ways and proportions. For example, to maintain uniform power distribution at different levels of the reactor core, fuel of lower degrees of enrichment is used at regions of higher neutron flux while fuel with higher degrees of enrichment is used in regions of lower neutron flux. Therefore, to operate the reactor in safety standards, these factors should be profiled to ensure constant power and flux within the reactor. The study of the profiles of NPP will enable scientists and engineers develop and design standard and accurate components of nuclear power system.

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MEDICAL APPLICATIONS OF ACCELERATORS FOR RADIOLOGICAL STERILIZATION

L.V. Chernov

Scientific Supervisor: Prof., Dr. Yu.Yu. Kryuchkov

Linguistic advisor: O. P. Kabrysheva

National Research Tomsk Polytechnic University,

Russia, Tomsk, Lenin avenue 30, 634050

E-mail: lvc2@tpu.ru

Introduction. Accelerators of electrons are very popular nowadays due to the latest achievements of nuclear technology in medicine. They are used as sources of ionizing radiation, as diagnostic equipment, in radiosurgery and in different modifications of X-ray equipment almost in all countries of the world [1].

Radiological sterilization of medical items is one of the biggest industrial processes using ionizing radiation. At present more than 50% of single-use medical items are sterilized particularly by this one [2].