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**USE OF MECHATRONIC SUBSYSTEMS IN MASS-EXCHANGE  
COLUMN APPARATUSES**

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**ABSTRACT:** The feasibility of using mechatronic subsystems in mass-exchange column apparatuses has been experimentally substantiated. The technical solution allows to provide separate movement of liquid and steam at continuous supply of streams, to carry out controlled cycles of delay and overflow of liquid, to prolong the interval of their contact, to increase the efficiency of extraction of alcohol impurities by 38% and to reduce steam consumption by 40%.

**Key words:** *ethanol, rectification, impurities, mass exchange, column, steam.*

**ВИКОРИСТАННЯ МЕХАТРОННИХ ПІДСИСТЕМ В  
МАСООБМІННИХ КОЛОННИХ АПАРАТАХ**

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**АНОТАЦІЯ:** *Експериментально обґрунтовано доцільність використання мехатронних підсистем в масообмінних колонних апаратах. Технічне рішення дозволяє забезпечити роздільний рух рідини і пари за безперервної подачі потоків, здійснювати контрольовані цикли затримки і*

*переливу рідини, подовжити інтервал їх контакту, підвищити ефективність вилучення домішок спирту на 38 % та зменшити витрати пари на 40 %.*

**Ключові слова:** *спирт, ректифікація, домішки, масообмін, колона, пара.*

The authors of the proposed technical solution for the creation and use of mechatronics subsystems for organizing managed cycles of rectification. It is established that the implementation of electro-mechanical and pneumo-electronic management system allows you to maintain separate movement phases under the continuous supply of the column of liquid and steam flows, to increase the surface area of contact of phases by 20%, to extend the time of contact of phases to achieve the phase equilibrium between liquid and steam, increase the efficiency of mass transfer and bring efficiency of real plates to the effectiveness of the theoretical. The aldehydes and esters are allocated in full volume, the degree of extraction of higher alcohols and methanol will increase by 38%, the concentration ratio of the head of impurities increases by 25%, higher alcohols 40%, methanol by 37%.

Realisation of the technical solution assumes inclusion in the pneumatic scheme of the unit of the pneumo-axis 32MPA for regulation and control of pneumatic actuators operation by means of the microprocessor controller. The control system includes a panel in which the controller is located and a computer. The controller includes a processor, network module, blocks of analogue and discrete inputs/outputs. The computer provides a conditional visualisation of the process and the necessary process controls are provided. Unity Pro software environment was used to create the software control of pneumatic cylinders. The programme text was developed in two languages - FBD and ST. For remote control of electric actuator with pneumatic cylinders a standard electropneumatic cabinet of ERSV-RIO-MPA-32/32 series with Profibus-DP type communication interface with air preparation unit is provided.

**Conclusions.** The use of mass-exchange apparatuses equipped with mechatronic subsystems makes it possible to ensure the removal of aldehydes and esters, increase the recovery rate of higher alcohols and methanol by 38% and reduce the heating steam consumption by 40%.