

COMPUTER MODELING OF SHELL-TUBE HEAT EXCHANGER DEVICE IN OIL REFINING TECHNOLOGICAL SYSTEM

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Annotation:In this article, the shell-and-tube heat exchanger used in the technological system of oil refining is modeled using solid work software. The prepared model was simulated and the results were analyzed and several conclusions were drawn.

Key words:oil, different fractions of oil, heat exchange process, shell-and-tube heat exchanger, simulation, solid work.

Introduction:Current in the day oil again work in factories heat exchange from devices wide is used. Heat exchange on the device complicated heat exchange process will pass This the process at first mathematician after making it with a computer model after it is built , it simulation to do through the process sure description enable gives [1].

Theoretical part:Heat treatment is an important step in oil refining. Light, medium and heavy fractions of oil are separated at different temperatures. When oil is heated to 180-200 °C, the gasoline fraction of hydrocarbons boils, at 200-250 °C the lignin fraction, at 250-315 °C the kerosene-gasoline fraction, and at 315-550 °C the oily fraction. The residue consists mainly of tar [1], [2].

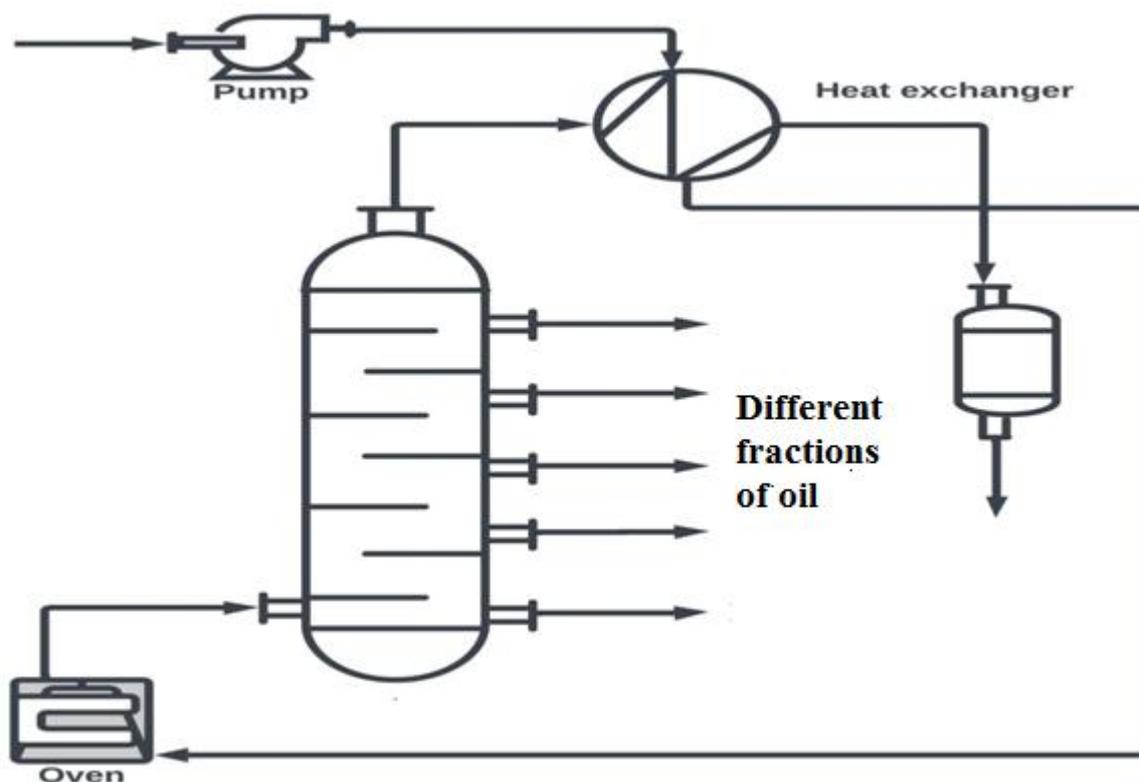


Fig. 1. Technological scheme of oil processing.

The above technological scheme describes a shell-and-tube heat exchanger. This device used in oil refineries has high efficiency. This device is used in various industries. The shell-and-tube heat exchanger is one common shell and pipes are placed inside it. Figure 2. As the number of tubes inside increases, the heat exchange surface and hydraulic resistance increase. This complicates the structure of the heat exchanger. Shell and tube heat exchangers are vertical or horizontal. Vertical heat exchangers are easy to use, their structure is simple and takes up little space. Horizontal heat exchangers are usually made with multiple pipes. In these devices, the elongation of the pipe and shell is different depending on the difference in the movements between the shell and the pipe [2]. A horizontal shell-and-tube heat exchanger is also installed in the oil refinery.

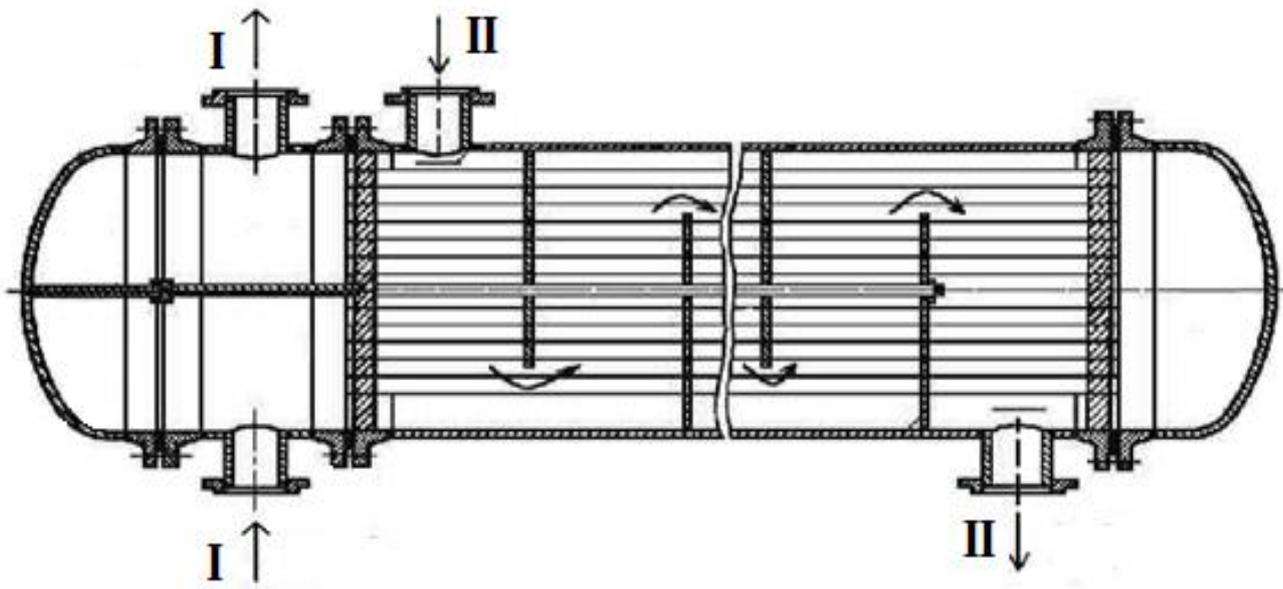


Figure 2. Shell-tube (track) heat exchanger device. I and II, respectively, are the inlet and outlet of cold and hot agents to the device.

By applying modern devices to the process, we can make the process faster and improve the quality of the sorted product. Before applying the device to the process, its computer model is created, and various tests are conducted on the computer based on this model. Today, such tasks are performed through the CAD/CAM/CAE system [3]. This the simulation done increase for now becoming popular going and different different studies take to go for intended. SolidWork practical from the program we use This is a program using oil again work technological in the system applied _ shell-tube heat exchanges the device one how many details model separately we created

The heat exchanger consists of several parts: shell, pipe, back and front covers, nozzles for changing the flow direction, 2 headers and pipes. Here, the number of pipes is 56 and the length is 1 meter. In the device, currents move in opposite directions relative to each other. Through this, we will be able to intensively carry out the heat exchange process.

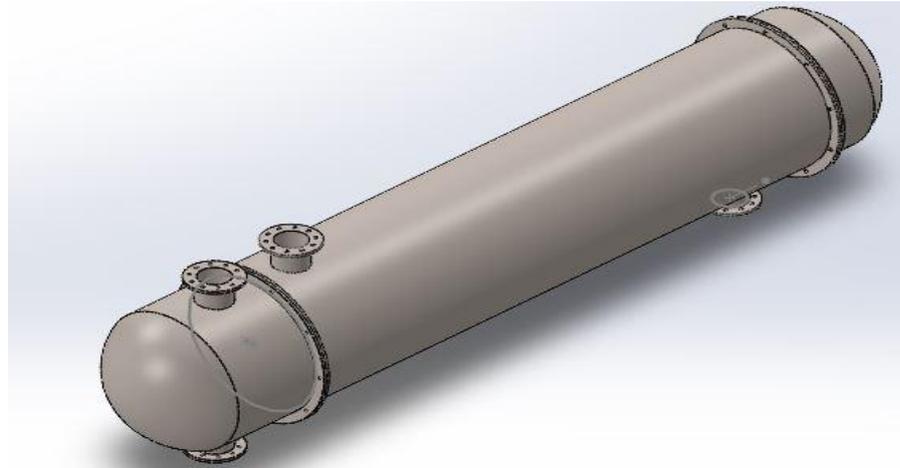


Figure 4. Computer model view of heat exchanger.

Simulation is essentially bringing the device or process closer to the device or process through computer modeling, whether it is a technological device used in a technological system or a technological process. It takes into account any external influences [4]. As we simulate the device, we cannot guarantee its 100% adequacy. The reason is that it is impossible to take into account the maximum influencing factors. There are countless internal and external influencing factors. By creating a computer model and simulating it in an application program, we can bring it to 95% similarity. And this test experience or expletives transfer for very gives a high effect. From this except research their work takes to go the time and spend the cost reduces.

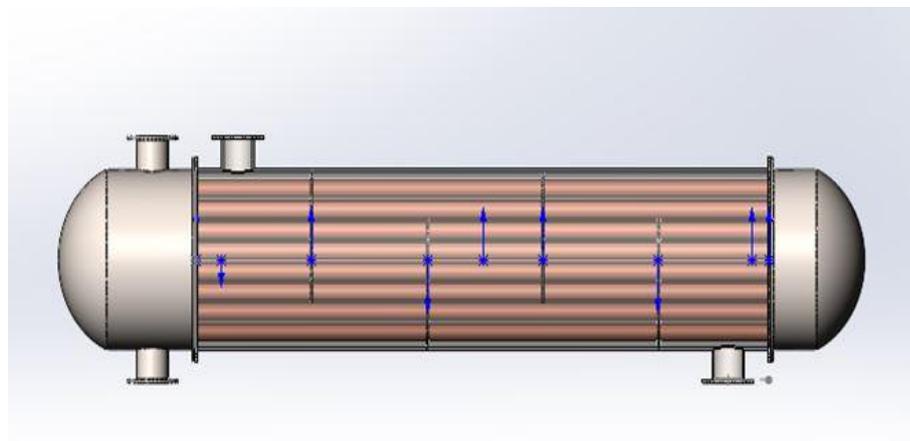


Figure 5. Simulation for prepared model.

Method . Computational Fluid Dynamics (CFD) - analysis of fluid flow, heat-related systems, is the process of computer-based simulation of fluid and gas flows through and around a device to calculate product performance and capabilities, and related phenomena such as chemical reactions and the laws of conservation of mass and energy . This technique is very powerful for use in a wide range of industrial and non-industrial sectors. CFD codes are built around numerical algorithms that can deal with fluid flow. CFD involves complex user interfaces. Using this technique, it is possible to simulate the heat exchange process of the heat exchange device used in the technological system of oil processing, and we will try to study it in practice[5],[6].

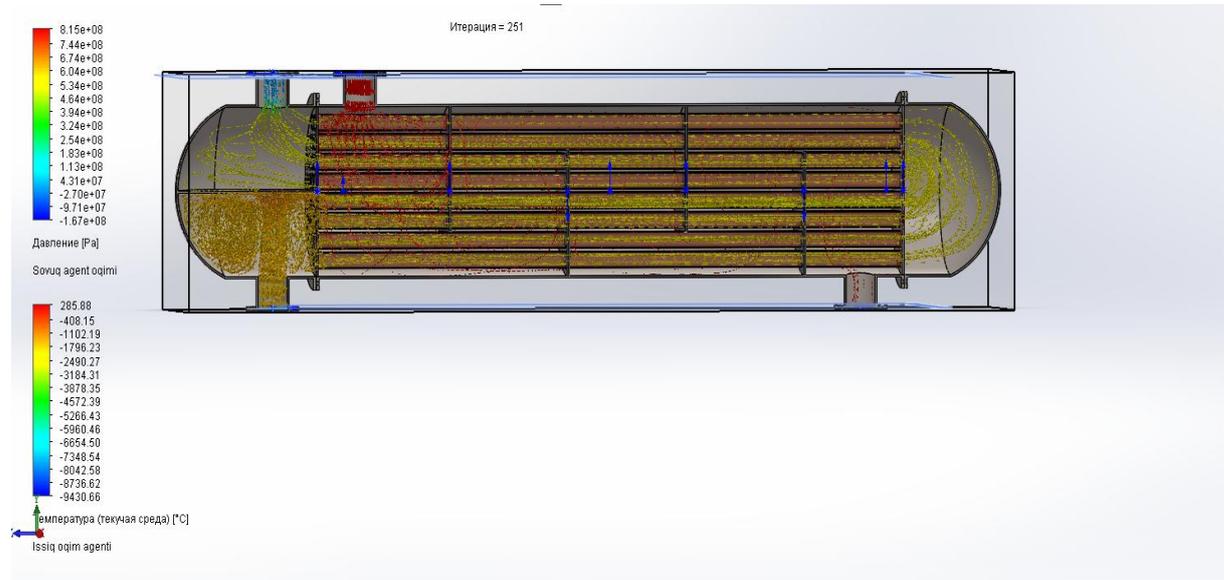


Figure 6. Simulation of a heat exchanger.

The result. In the figure above we can see the simulation of flows and heat exchange. We introduced a cold agent from the bottom of the device. As a cold agent, we entered water and its temperature $T=10^{\circ}\text{C}$, and consumption $G=0.5\text{ kg/sec}$. The hot agent is propane liquid, temperature $T=120^{\circ}\text{C}$ and consumption $G=0.5\text{ kg/sec}$.

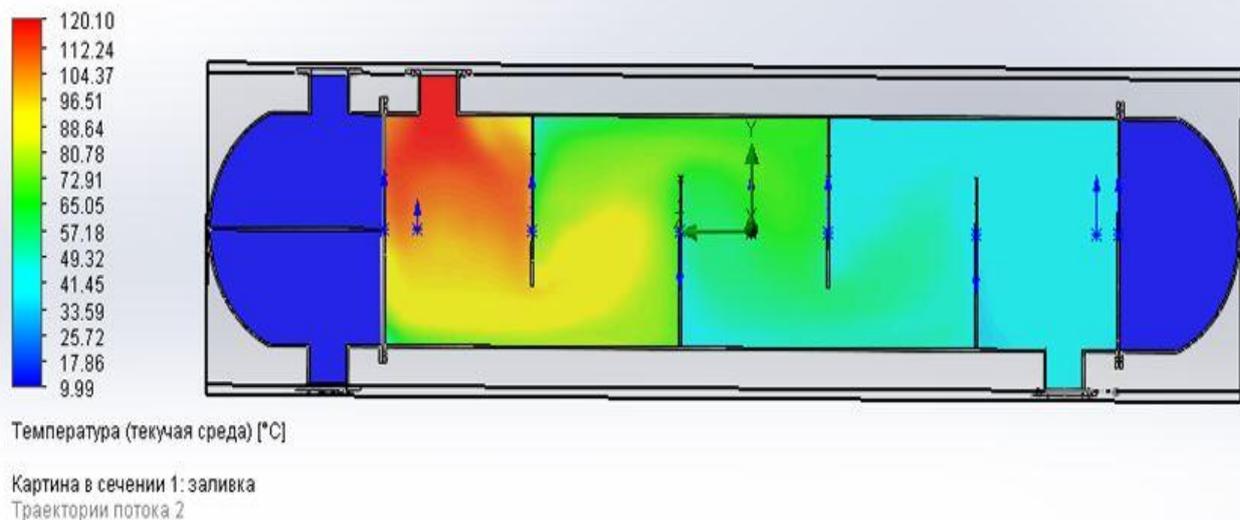
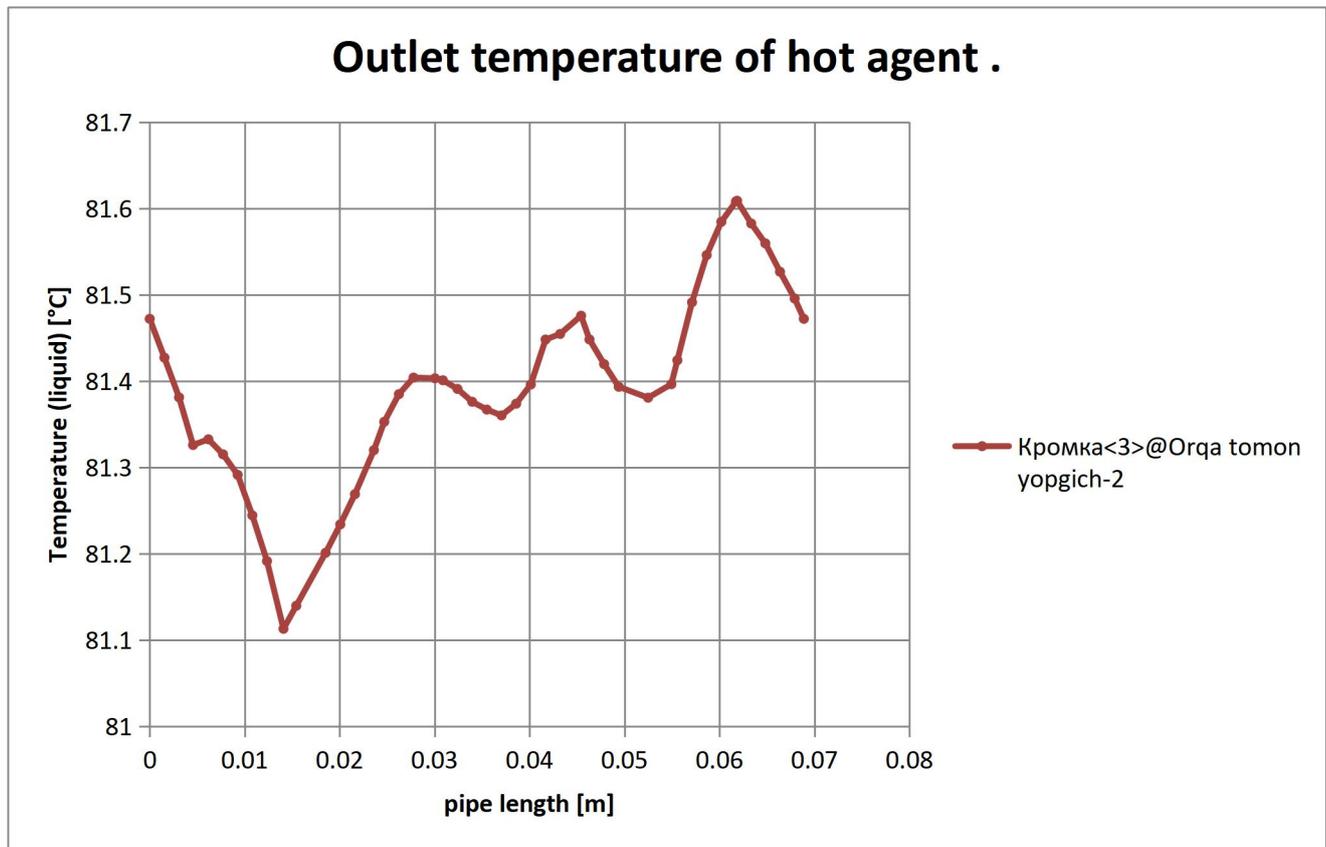


Figure 7. Change in the temperature of the hot agent.

From the simulation of the heat exchange process, the temperature to which the propane is cooled is reflected by colors. We can see that the heat exchange is uneven along the entire length of the device. SolidWorks Simulation uses a generative method to support device optimization. Device variables vary between their respective lower and upper limits. This package combines variables to create graphs of individual values. Finite element analyzes are performed for all scenarios generated.

Feasible projects are grouped among the evaluated scenarios. The best result that gives the lowest value in the objective function within the feasible set is defined as the solution of the problem.



Graph 1. Graph of the final temperature of the hot agent.

The main advantages of automated systems of engineering design (CAD/CAM/CAE), conducting scientific research on the devices of the production enterprise, simulating the response of the devices to various external factors, in particular pressure, force, temperature and other physical effects, were studied. . Graph 1 above is a graphical representation of the temperature change of the hot agent (propane) entering the shell-and-tube heat exchanger at the exit of the unit.

Conclusion: A shell-and-tube heat exchanger device used in oil refineries was simulated by the SolidWork software. A shell-and-tube heat exchanger was selected as a research object. The use of CAD/CAM/CAE systems, not only in the production process, but also in the fields of design, modeling, and automation, allows enterprises to design the devices of the enterprise-plant without spending excessive resources and time, without allowing wastage, helps to eliminate possible problems in the production line.

In short, computer modeling of systems can predict numbers based on system usage and machine learning techniques such as Gaussian processes and neural networks. Among other things, it allows dynamic selection of control rules. In addition, it allows the assessment of cause-effect relationships within processes, as well as the correlation between input parameters and their effect on the process.

References:

1. NR Yusupbekov, Sh.I. Muhamedov, Sh.M. Ghulomov Control and automation of technological processes: a textbook for technical universities /. - T.: Teacher, 2011.

2. NR Yusupbekov , DP Mukhitdinov " Technological processes modeling and optimization basics " Tashkent 2015 p. 3.
- Miltiadis A. Boboulos "CAD/CAM & Rapid Prototyping Application Evaluation", 1st edition. 2010 y.
4. В.П.Прохоренко "SolidWorks практическое руководство", – Москва издательство БИНОМ: 2004 г.
5. Matt Lombard "Mastering Solidworks" 2018 y.
6. Alejandro Reyes "Beginner's Guide to SOLIDWORKS 2021" 2021 y.
7. James D. Bethune "Engineering Design and Graphics with SOLIDWORKS 2016. Chapter", Boston: Pearson / 2017 ISBN 10: 0- 13-450769-X, ISBN 13: 978-0-13-450769-9.
8. Abduraxmonov O.R, Sadullayev A.N "Mathematical Modeling of Oil Heating Process", MIDDLE EUROPEAN SCIENTIFIC BULLETIN Volume 30 | nov-2022 ISSN 2694-9970.
9. Abduraxmonov O.R, Sadullayev A.N "Mathematical modeling of the process of heat exchange in the technological system of oil refining" "Science and Education" Scientific Journal / ISSN 2181-0842 April 2022 / Volume 3 Issue 4.
10. Abduraxmonov O.R, Sadullayev A.N "NEFTNI ISITISH JARAYONINI MATEMATIK MODELLASHTIRISH" Journal of Advances in Engineering Technology Vol.4(8) "Automation & control of technological processes" 2022 year.