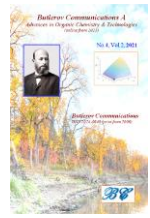
BUTLEROV HERITAGE

Butlerov Communications A
Advances in Organic Chemistry & Technologies
ISSN 2074-0948 (print)

2021. Vol.2, No.4, Id.12.
Journal Homepage: https://a-journal.butlerov.com/



Thematic section: Constructional Studies.
Subsection: Processes and Apparatus of Chemical Technology.

Full Paper

The Reference Object Identifier – ROI-jbc-A/21-2-4-12
The Digital Object Identifier – DOI: 10.37952/ROI-jbc-A/21-2-4-12
Received 18 August 2021; Accepted 21 August 2021

Development of a vortex column for denitration of spent acids for the Federal State Enterprise "Aleksinsky Chemical Plant"

Alexey F. Makhotkin,* **Rifkat A. Khalitov**,[+] and **Marat R. Zubaerov**
Department of Equipment of Chemical Plants. Engineering Chemical and Technological Institute. Kazan National Research Technological University. K. Marx St., 68. Kazan, 420015. Republic of Tatarstan. Russia. Phone: +7 (843) 231-40-90. E-mail: kstuoxz@gmail.com

*Supervising author; [+]Corresponding author

Keywords: denitration, spent acid mixtures, hydraulic resistance, spray carrier, volume concentration of the liquid phase, vortex column.

Abstract

Currently, cellulose nitrate production plants use bubbling-type denitration columns for the denitration of waste acids, which are characterized by low productivity for the resulting 98% nitric acid. The development of a denitration column operating in a wide range of load changes in the gas and liquid phases, and, consequently, performance, is an urgent task. A new design of a vortex denitration column has been developed, which ensures operation at both low and high productivity for the resulting 98% nitric acid. The new denitration column consists of a set of vortex contact stages installed on top of each other. Each vortex stage consists of the lower and upper tsars installed on top of each other. The lower tsarga is made with a plate, and the upper tsarga is flanged. A swirler is installed on the plate, inside of which, on the opening of the plate, a gas pipe is installed. A contact pipe is installed on the flanging of the upper tsarga. The location of the gas nozzle inside the swirler, the upper section of which is located above the swirler blades, allows the contact stage to operate in a wireless mode at low gas phase flow rates and high liquid phase flow rates. The flow of liquid between the stages is carried out along the flow lines installed outside the column Experimental studies of the hydrodynamic characteristics of the model of the vortex contact stage of the column have been carried out. The dependences of the hydraulic resistance, splashdown and retention capacity on the flow rates of the gas and liquid phases are obtained. The research results have shown that the vortex stage works stably both at low and high flow rates of the gas and liquid phases with low hydraulic resistance. A complete set of design documentation for the vortex column of spent acid denitration has been developed. The developed design of the vortex column has been accepted for implementation at the Aleksinsky Chemical Plant.

For citation: Alexey F. Makhotkin, Rifkat A. Khalitov, Marat R. Zubaerov. Development of a vortex column for denitration of spent acids for the Federal State Enterprise "Aleksinsky Chemical Plant". *Butlerov Communications A.* **2021**. Vol.2. No.4. Id.12. DOI: 10.37952/ROI-jbc-A/21-2-4-12

References

[1] R.A. Khalitov, A.F. Makhotkin. Technology of regeneration of waste acids in vortex apparatuses: monograph. *Kazan: KNITU Publishing House.* **2015**. 384p. (Russian)

[2] *Patent 2607208 Russian Federation* IPC B01D 3/32. Acid concentration column. Khalitov R. A. [et al.]; the applicant and the patent holder of the FGBOU VO "KNITU" No. 2015127331; application 07.07.2015; publ. 10.01, **2017**, bul. No.1. (Russian)

[3] Alexey F. Makhotkin, Rifkat A. Khalitov, Marat R. Zubaerov. Development of a vortex column for denitration of spent acids for the Federal State Enterprise "Aleksinsky Chemical Plant". *Butlerov Communications.* **2021**. Vol.68. No.10. P.16-21. DOI: 10.37952/ROI-jbc-01/21-68-10-16 (Russian)