POLLUTION OF THE ENVIRONMENT BY HYDROGEN SULFUR AND METHODS OF ITS PROTECTION

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Annotation. This article discusses environmental protection from pollution by Neftegaz and petroleum products. It provides methods and analysis of the composition of the initial mixture and waste gas. Experimental data are also presented.

Keywords: Environmental protection, hydrogen sulfide pollution, Claus process, reactor.

Аннотация. В данной статье рассматриваются вопросы охраны окружающей среды от загрязнения Нефтегазом и нефтепродуктами. Приведены методы и анализ состава исходной смеси и отработанного газа. Также представлены экспериментальные данные.

Ключевые слова: Защита окружающей среды, сероводородные загрязнения, окружающая среда, процесс Клауса, реакторы.

Annotatsiya. Ush bu maqolada neftgaz va neft mahsulotlarining ta’sirida ifloslanishi atrof-muhitni muhofaza qilish masalalari ko'rib chiqiladi. Dastlabki aralashmaning tarkibi va chiqindi gazining usullari va tahlillari keltirilgan. Shuningdek, eksperimental ma'lumotlar keltirilgan.

Kalit so'zlar: Atrof-muhitni muhofaza qilish, atrof-muhitning vodorod sulfidi bilan ifloslanishi, Klaus jarayoni, reaktor.

Introduction

The main sources of anthropogenic pollution are the extraction and processing of oil and natural gas. A large amount of hydrogen sulfide is released during the bacterial decomposition of human and animal waste. The toxic gas is also present in emissions from wastewater treatment plants and landfills.

Sulfur dioxide is also released into the environment from industrial sources. These include oil refineries, natural gas producers, pulp and paper mills, manure processing plants, tanneries, and wastewater treatment plants. To calculate the gas purification system and create safe working conditions, these enterprises order measurements of hydrogen sulfide in the air. Hydrogen sulfide (H_2S) is a toxic gas with a rotten egg smell. H_2S emissions are dangerous for health and the environment. People who live in close proximity to farms, manure storage tanks, or pulp and paper mills are most affected. However, people in the workplace are much more exposed to this gas than those from these sources.

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Main technologies used and under development for purifying natural gas from hydrogen sulfide. Currently, the following processes are used to purify natural gas from H2S and CO2:

• chemisorption processes based on the chemical interaction of H2S and CO2 with the active part of the absorber;

• physical absorption processes, in which the extraction of acidic components occurs due to their solubility in organic absorbers;

• combined processes that use both chemical and physical absorbers;

• oxidative processes based on the irreversible conversion of absorbed hydrogen sulfide into sulfur.

• Natural gas can also be purified from hydrogen sulfide using adsorption processes based on the extraction of gas components by solid absorbents.

Purification of natural and other gases from hydrogen sulfide can be carried out using various methods.

The choice of the process for purifying natural gas from sulfur compounds depends on many factors, the main ones being:

• composition and parameters of the feed gas,

• required degree of purification and the area of use of the commercial gas,

• availability and parameters of energy resources, production waste, etc.

Protecting the environment from pollution caused by oil and petroleum products is crucial; given that over 2,5 billion tons crude oil are produced annually in the worldwide. A significant consequence of intensifying oil production is pollution of the natural environment with oil and its by-products.

Vapors emitted from oil and petroleum products are toxic and pose a harmful effect on the human health, especially those from sulfur oil and sulfur gases, and leaded gasoline.

Hydrogen sulfide pollution and methods of its disposal are one of the most pressing concerns for the global community.

The main industrial process for the producing elemental sulfur is the Claus process, involving the high-temperature combustion of hydrogen sulfide to sulfur dioxide and the subsequent production of elemental sulfur. However, when the gas contains less than 40% hydrogen sulfide, the Claus process becomes economically unavailable.

Under such circumstances, the direct one-stage oxidation of hydrogen sulfide to elemental sulfur using oxide catalysts proves to a more appropriate method.

This study focus on developing a method for the catalytic oxidation of hydrogen sulfide to ensure almost complete conversion into environmentally friendly sulfur.

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It is known that the oxidation reaction of hydrogen sulfide is exothermic, which allows it to be carried out without heat supply. However, at high concentrations of hydrogen sulfide, the amount of heat released may be so large that when the process is carried out in an adiabatic reactor, the temperature in it will increase above the permissible level. Calculations show that during the oxidation of 1% H_2S into elemental sulfur under adiabatic conditions, the temperature of the gas mixture increases by 60-65 ^{0}C. Therefore, to maintain the temperature in the reactor in a given range, it is necessary either to ensure heat removal from the reactor, or to dilute the gas to an acceptable level of hydrogen sulfide concentration before entering the reactor.

The proposed technology does not require special design; the heat generated and the resulting sulfur are removed from the reaction zone by separately supplying oxygen to each stage. The control diagram for the technological parameters of the installation is shown in Figure 1.

This paper presents the results of research on the development of technology for the catalytic neutralization of hydrogen sulfide-containing emissions from a gas processing plant.

The product, a gas of the following composition, was subjected to oxidation:

hydrogen sulfide – 28 – 30 vol.%;

carbon dioxide – 5.5 – 6.0 vol.%;

methane – 3 – 7 vol.%;

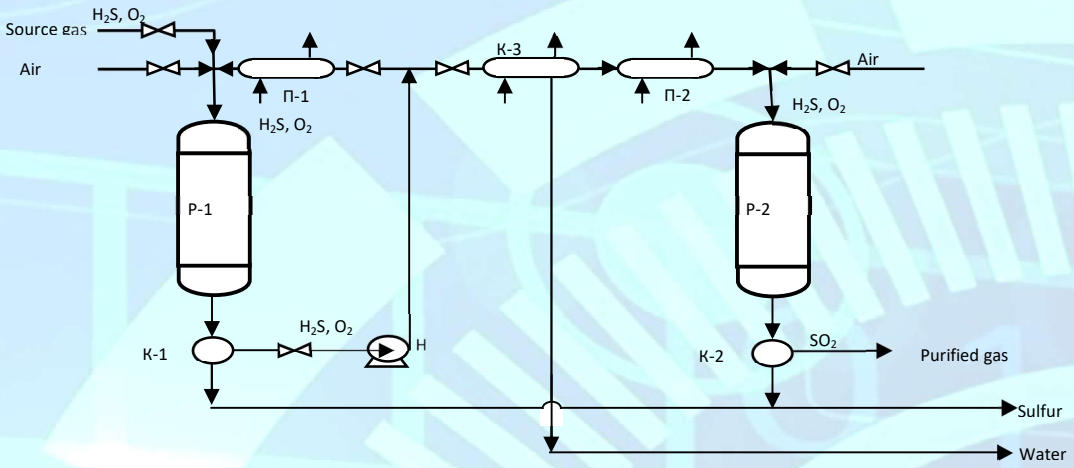
water – 3 – 4 vol.%.

The composition of the initial mixture and exhaust gas was analyzed by chromatography. The resulting oxidation reactions of H_2S, sulfur and water are condensed and captured in intermediate containers after each stage.

The maximum conversion of hydrogen sulfide into elemental sulfur, with 100% selectivity, is achieved with the following process parameters.

The experiments showed that if the concentration of H_2S in the purified gas is reduced to 4 vol.% by diluting it at the first stage of the installation and oxygen is added to it in an amount ensuring the O_2/H_2S ratio equal to 0.25-0.3 at a space velocity of 3600 hours -1 and the temperature in the first reactor is 300 °C gas, the outlet from the reactor will contain 2.13 vol.%, H_2S.

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Picture 1. Scheme for monitoring the technological parameters of the installation

If the mixing of this gas with air is brought to a state at which the concentration of the O_2/H_2S ratio is 0.6-0.7 and it is passed through the second reactor at a volumetric speed of 3000 h-1, at a temperature of 255 ° C, then at least 90% H_2S will turn into elemental sulfur and a small part of it will oxidize to SO_2. If the concentration of H_2S in the purified gas is increased above 6.0% by mass, then an uneven temperature distribution is observed across the catalyst layers, which negatively affects the process.

The experimental data obtained showed that:

– when maintaining the O_2/H_2S molar ratio at the reactor inlet less than 0.35, no sulfur dioxide is formed, and all oxygen is consumed for the oxidation of hydrogen sulfide into elemental sulfur,

- with an O_2/H_2S ratio of 0.6, the amount of SO_2 formed during H_2S conversion is above 99.0% and depends on the water vapor content in the gas. With virtually no water vapor, the SO_2 concentration at the outlet is 0.15 vol.%, and with a water vapor content of 20 vol.%, the concentration of sulfur dioxide is 0.32 vol.%.

Thus, depending on the SO_2 content requirements in the exhaust gas, the issue of removing water from reaction mixture by concentrating it in special devices. Given the selected CO_2 catalyst, hydrogen and methane do not undergo any transformations.

LITERATURE

1. Podshivalin A.V. Modern technology for the production of elemental sulfur // Oil and Gas Business. 2006. T. 4. No. 1. pp. 231 - 234.

2. Azizova, D. G. (2023). USE OF INNOVATIVE TECHNOLOGIES IN GAS EXTRACTION EFFICIENCY FOUNDATION. Innovation: The journal of Social Sciences and Researches, 1(4), 5-8.

3. Sattorov, L., Nomozov, B., & Azizova, D. (2021). CHARACTERISTIC OF METHODS FOR INCREASING HYDROCARBON PRODUCTION OF GAS

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CONDENSATE AND GAS CONDENSATE OIL FIELDS. Norwegian Journal of Development of the International Science, (76-1), 40-43.
4. Panoyev Erali Rajabboyevich, Temirov Alisher Hoshim o‘g’li, Akhmedov Vokhid Nizomovich (Bukhara, Uzbekistan) The corrosion problem in the oil and gas industry . Polish science journal (ISSUE 10(43), 2021) - Warsaw: Sp. z o. o. "iScience", 2021
5. Xamidov, D. G. A., & Temirov, A. H. O. G. L. (2020). Parafinli neftlarning fizik-kimyoviy xossalari tahlili. Science and Education, 1(9).

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