Information about authors:

Annaqulov Tulqin Jovbekovich	–	Head of the department of mining electromechanics, PhD, Associate professor; Tashkent State Technical University, 100095, Tashkent, University Str., 2, Republic of Uzbekistan ORCID: https://orcid.org/0000-0003-3106-144X , e-mail: a.tulkin1275@yandex.ru
Ziyadov Nusrotullo Rahmotulloyevich	–	Senior lecturer at the department of Mining electromechanics, Tashkent State Technical University, 100095, Tashkent, University Str., 2, Republic of Uzbekistan ORCID:https://orcid.org/0009-0004-7613-6307e-mail: ziyadovnusratillo@gmail.com

LITERATURE ANALYSIS ON INCREASING THE CLEANING EFFICIENCY OF AIR FILTERS OF MACHINES USED IN MINING ENTERPRISES

L.N.Ataqulov, B.Kh.Shomurodov

Navoi State University of Mining and Technology

Doi: 10.5281/zenodo.18092644

ABSTRACT The article provides essential information about the contamination of air filters in mining machines used at mining enterprises, meaning the reduction in operational efficiency caused by dust or other airborne particles and their negative impact on the machine's performance. In addition, a scientific analysis of the literature aimed at improving the efficiency of air filter cleaning systems used in today's mining industry of our country is presented. In addition, the research methodology section of the article scientifically substantiates the issues of improving the process of effective air filter purification using the method of theoretical analysis, the method of mathematical modeling, and the methods of experimental tests. The article thoroughly analyzes the air filters currently used in mining machines and proposes the use of an improved filter cleaning device to improve the filter cleaning process.

KEY WORDS air filters, cleaning, pressure, filter cleaning device, filter cleaning coefficient, internal combustion engine.

INTRODUCTION

Today, the most widely used engines in mining and transport vehicles that are directly involved in the extraction, loading and delivery of minerals to enrichment plants in mining enterprises are internal combustion engines. Due to the high dust content in open-pit mining facilities, i.e. quarries, the air filters of mining machines used in quarries become clogged with dust particles much faster than expected, so cleaning the air filters of machines used in the mining industry is one of the most urgent issues today.

The continuous, reliable and high-performance operation of the internal combustion engine of mining machines directly depends on the purity of the amount of air supplied to it and the quality of the filtered air flow, which proves the need for constant, systematic cleaning of air filters. Therefore, improving the timely and high-quality cleaning devices for mining machine air filters, ensuring the performance, efficiency, and long-term operation of not only air filters, but also the internal combustion engine and mining machines, is one of the urgent problems of today.

LITERATURE ANALYSIS

Today, many researchers and scientists are conducting a number of scientific studies on the issues of improving the air filter cleaning systems of mining machines, updating the design of filters, increasing their service life. The long-term operation of mining machines and internal combustion engines is a quantity that depends on many external and internal factors. Today, there are many modern methods of cleaning air filters, and cleaning air filters of mining machines is carried out at the repair sites or equipment service facilities of every large giant enterprise [1].

Nowadays, many foreign researchers and scientists are conducting scientific research on the improvement of air filter cleaning systems for mining vehicles, including: Marius Tomaa, Iordan Filerua, Peyyang Li, Yatsek A. Koziel, Nubia Macedo, Jeffrey J. Zimmerman, Danielle Wrzesinski, Erin Sobotka, Mateo Balderas, William B. Waltz, Reed Vincent Paris, Myongson Li, Dongjie Liu, Bauyrjan Yedilbayev, Brett C. Ramirez and William S. Jenks. Despite the ongoing scientific research and experiments, the problems of improving air filter cleaning systems have not been fully resolved to this day [2].

On the issues of improving air filters for mining vehicles, scientists of our republic, such as Bozorov B.I., Abdurashidov A.A. and others, have also conducted many scientific research and studies,

prepared experimental test stands and achieved good results [3].

Despite the many results achieved on the basis of numerous scientific researches and experiments conducted by foreign and domestic scientists, cases of various types of dust particles entering the internal combustion engines of mining machines used in mining enterprises today, and their negative impact on the performance of internal combustion engines, as well as cases of damage and failure of engines due to dust, are observed in the mining industry. Taking into account the above, the article aims to address the issues of improving the air filter cleaning system of mining machines and to determine the tasks for scientific research based on analytical analysis [4].

RESEARCH METHODOLOGY

Air filter cleaning systems for mining machines serve as the basis for increasing the efficiency and ensuring long-term, reliable operation of internal combustion engines. Scientific research and scientific-practical research on the improvement of air filter cleaning systems are carried out on the basis of a wide variety of methodological approaches, below we will analyze the main types of research methodologies currently being conducted [5]:

1. Theoretical analysis method - in this method, it is necessary to analyze the literature analysis and foreign and local scientific researches, articles and theses, as well as the data collected on the topic. In this section, the methods and possibilities of cleaning the air system entering the engine in order to protect the internal combustion engine of mining machines from various types of dust are studied and analyzed.

2. Mathematical modeling method - in this methodological method, it is possible to use a number of mathematical methods for cleaning the air filters of mining machines in the object of scientific research and the loss of air pressure supplied to it, as well as the nominal values of air speed.

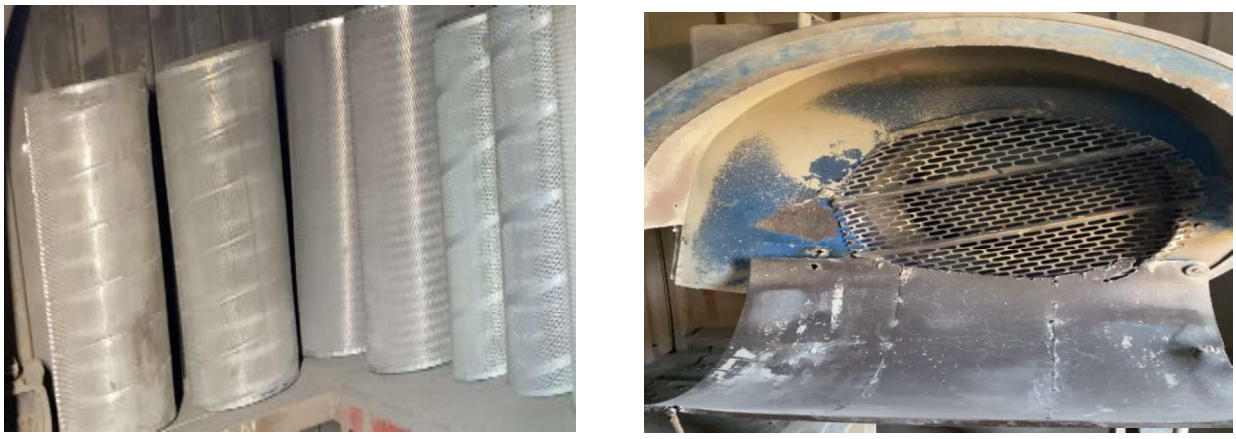
3. Experimental research method - in this method, an experimental test stand is prepared to conduct scientific research to improve the cleaning efficiency of mining machinery dust filters and improve the methods of cleaning filters from dust. We can determine the effectiveness of increasing the cleaning efficiency of filters from dust through several types of tests:

- the method of comparing the initial mass of the filters and the masses after cleaning;
- resistance of the filters to the applied pressure before cleaning and resistance to the pressure after cleaning is measured;
- the method of determining the dust capacity, surface, porosity and filter size on the surface of the filter and several other methods.

Taking into account that the combined and generalized application of the above research methods increases the scientificity and reliability of the research work, we conducted a scientific research study in the article using theoretical analysis and mathematical modeling methods [6].

DISCUSSIONS AND RESULTS

Today, the process of cleaning air filters of transport vehicles, mainly used in open-pit mining enterprises, is organized at each facility in order to increase the efficiency of the enterprise. Figure 1 below shows a device for cleaning the air filters of mining vehicles using a compressor and cleaning the dust coming out of the filter with an additional fan device located behind, but this method shows that the air filters are poorly cleaned.



(a) filters used in mining (b) filter cleaning device in the factory

Figure 1. Air filter cleaning device for air filters used in mining enterprises

Based on the research and experiments conducted, we can say that cleaning air filters only by blowing air with a compressor reduces the cleaning efficiency of these filters by an average of 30-40%, and the cleaned filters are clogged with dust again, and their operating time is very short [7].

According to the analysis of the literature and taking into account the above indicators, we propose an experimental test device for cleaning air filters with a special rotary and reciprocating motion for cleaning air filters of mining machines:

a) mining machine air filter

b) special filter cleaning device offered

Figure 2. Mining machine air filter and proposed device for cleaning it

Due to the fact that air filters currently used in mining enterprises operate at very low efficiency levels and the very low cleaning coefficient of this device, a new, more efficient filter cleaning device, shown in Figure 2, has been proposed.

CONCLUSION AND SUGGESTIONS

Nowadays, the cleaning devices used in the filter cleaning areas of mining enterprises for cleaning air filters of mining machines are mainly used in the air spraying, dust suction and rotary motion of the filters. The filter cleaning device we offer is an effective device with higher efficiency and reliability than existing filter cleaning devices, as a result of preventing the loss of air pressure from the compressor during filter cleaning and providing additional vibration.

Air filters for mining machines are special devices that clean the air flow entering the internal combustion engine of various dust and other substances, ensuring the speed, reliability and other parameters of the internal combustion engine.

When used in mining enterprises, the proposed air filter cleaning device removes 80-90% of the dust accumulated in the filters, which, first of all, increases the efficiency of cleaning the dust filters, and is one of the main parameters for increasing the reliability, long-term operation and labor efficiency of the internal combustion engine of mining machines. When used in mining enterprises, the proposed mining machine cleaning device serves as a new, modern and economically cost-effective device for mining machines that prevents their breakdowns.

ЛИТЕРАТУРНЫЙ ОБЗОР ПО ПОВЫШЕНИЮ ЭФФЕКТИВНОСТИ ОЧИСТКИ ВОЗДУШНЫХ ФИЛЬТРОВ МАШИН, ПРИМЕНЯЕМЫХ НА ГОРНЫХ ПРЕДПРИЯТИЯХ

Л.Н. Атакулов, Б.Х. Шомуродов

Навоийский государственный горно-технологический университет

АННОТАЦИЯ

В статье приведены необходимые сведения о загрязнении воздушных фильтров горных машин, используемых на горнодобывающих предприятиях, то есть о снижении эффективности работы из-за пыли или других воздушных частиц и их негативном влиянии на работу машины. Кроме того, представлен научный анализ литературы, посвящённой повышению эффективности систем очистки воздушных фильтров машин, применяемых в современной горнодобывающей промышленности нашей страны. Кроме того, в разделе "Методика исследования" статьи научно обоснованы вопросы совершенствования процесса эффективной очистки воздушного фильтра методом теоретического анализа, методом математического моделирования и методами экспериментальных испытаний. В статье подробно анализируются воздушные фильтры, используемые в настоящее время в горных машинах, и предлагается использовать усовершенствованное устройство для очистки фильтров для улучшения процесса очистки фильтров.

КЛЮЧЕВЫЕ СЛОВА воздушные фильтры, очистка, давление, устройство для очистки фильтров, двигатель внутреннего сгорания.

REFERENCES

1. Barris MA. Total Filtration TM, The Influence of Filter Selection on Engine Wear, Emissions, and Performance. SAE technical paper series, 952557.
2. Tellier, R. COVID-19: The case for aerosol transmission. Interface Focus 2022, 12, 20210072. [CrossRef]
3. Lerner, A.M.; Folkers, G.K.; Fauci, A.S. Preventing the spread of SARS-CoV-2 with masks and other "low-tech" interventions. JAMA 2020, 324, 1935.
4. Kim, H.-J.; Han, B.; Kim, Y.-J.; Jeong, C.-S.; Lee, S.-H. A simple and efficient method for evaluating air-cleaning performance against airborne allergen particles. Build. Environ. 2013, 60, 272–279.
5. Jaroszczyk T, Pardue BA, Holm CE. Recent Advances in Engine Air Cleaners Design and Evaluation, Journal of KONES Internal Combustion Engines. p. 259-275. 2004.
6. Toma M. Researches on the Influence of Maintenance Activity of Air Filters on the Dynamic Performances of Automotive Internal Combustion Engines. PhD Thesis, University Politehnica of Bucharest, 2013.
7. Bugli NJ, Green GS. Performance and Benefits of Zero Maintenance Air Induction Systems. SAE technical paper series 2005-01-1139.

Information about authors:

Ataqulov Lazizjon Nematovich –	Doctor of Technical Sciences, Professor Navoi State University of Mining and Technology, 100095, .Republic of Uzbekistan, Navoi, M. Torobiy Str., 72. ORCID: https://orcid.org/0000-0002-3561-8850
Shomurodov Baxtiyor Hamidovich –	Navoi State University of Mining and Technology, basic doctoral student. Republic of Uzbekistan, Navoi, M. Torobiy Str., 72. e-mail: baxtik.3008@gmail.com

ANALYSIS OF CAUSES AND METHODS OF SOLVING COMPLICATIONS IN URANIUM IN-SITU IN-SITU LEACHING TECHNOLOGY

J.B. Toshov[1], Sh.A. Makhmudov[2], G.A. Makhmudova[1]

[1]Tashkent State Technical University, Tashkent, Uzbekistan
[2]Navoi State Mining and Technological University, Navoi, Uzbekistan

Doi: 10.5281/zenodo.18092657

ABSTRACT The study examines the operational features of in-situ leaching (ISL) technology applied to the extraction of non-ferrous metals. The process chain is characterized by the injection of a leaching solution through specially drilled wells into the ore-bearing horizon, followed by the dissolution of target minerals and their subsequent recovery to the surface via production wells. In the course of ISL system operation, a number of typical complications arise, including clogging of the near-well zone, gas breakthrough, sanding phenomena, and scaling in tubing strings. These factors significantly influence the filtration regime and hydrodynamic behavior of the productive formation, which makes it necessary to regularly adjust and optimize the operating parameters. The paper highlights different categories of interventions aimed at enhancing system efficiency: chemical treatments, combined physico-chemical methods, as well as mechanical cleaning and rehabilitation of wells and downhole equipment. It is argued that sustainable and long-term operation of ISL systems can only be ensured through integrated application of these approaches, which reduces the risks of failures and extends the service life of wells. The research outcomes provide a methodological basis for improving the design and further optimization of ISL systems at both operating and newly developed deposits.

KEYWORDS in-situ well leaching, bottom-hole zone, colmatization, sanding, salt deposition, well cleaning, technological efficiency.

INTRODUCTION

When operating wells subject to the influence of mechanical impurities and colmatation, one of the key complications is the clogging of the bottomhole, well equipment, and the bottomhole formation zone (BFZ). This inevitably leads to a decrease in the well's production potential, expressed in lower withdrawal volumes of productive solutions. Similar difficulties are also observed during technological operations.