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Increasing Efficiency of Aspiration System and Dust Accidents

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ABSTRACT:On base of MPC material of the value is fixed in atmospheric air at most possible surge (MPS), providing in practice observance hygienic standards. There are improved the efficiency of dust collection equipment by upgrading the aspiration network in industrial enterprises. One of the ways to reduce the emissions of dust and other pollutants into the atmosphere is the introduction of modern or two-stage equipment for cleaning pollutants.

KEY WORDS: spontaneous permissible concentration, dust, pollutants, stationary source, spontaneous-permissible release, atmospheric layer, dust-gas-concentration plants (DGCP).

I.INTRODUCTION

Substances entering the atmosphere directly due to human activity are usually referred to as anthropogenic emissions and pollutants. In contrast to natural, the number of anthropogenic pollutants is not infinite, although it is extremely large. With rare exceptions, they do not find their place in the circulation of substances without disrupting the cyclist and closure of natural processes, and this is detrimental to the nature of the planet. The most notable of them become the objects of study and development of ways to neutralize the impact on the biosphere.

Air emissions are distinguished by type, composition, quantity, state of aggregation, nature of appearance and stay in the atmosphere, influence on the biosphere and many other signs. Classification of anthropogenic emissions, suitable for studying their properties in order to select cleaning methods, is not yet available. In the standard classification, pollutants are divided into 4 classes according to the state of aggregation: gaseous and vapor, liquid, solid and mixed.

The first class contains 18 individual substances and classes of chemical compounds; for the rest of the multitude of gaseous pollutants, the “Others” group is provided. The second class is represented by 5 groups of substances, each divided into 4 subgroups according to the size of suspended particles. The third class contains 6 groups of substances (with 4 subgroups by size), overlapping and duplicating each other by dividing signs. The fourth class involves a combination of characteristics of groups and subgroups of previous classes [1].

The considered principle of the classification of pollutants requires serious optimization. Leaving as the basis the primary separation on the basis of contamination of particles of pollutants, it would be advisable to distribute first-class pollutants according to the type and risk of environmental impact without specifying each substance, and for defining the characteristics of the second and third classes to accept the size of aerosol particles, considering the other properties as auxiliary signs.

The standard classification of emissions by quantitative recognition is reduced to the assignment of numbers to the daily volumes of pollutants emitted. Such a method of separation gives a minimum of significant information, and therefore it should be supplemented with other signs, for example, to distribute emissions by physical parameters, types of sources and others.

The required parameters of the air environment in the production premises are maintained within the specified limits by the rational organization of general exchange and local ventilation. Ventilation plays a significant role in preventing fires and explosions and in reducing the concentration of vapors, gases and dust to safe limits.

The main hazard in grain processing enterprises is dust, therefore, along with general exchange ventilation systems; considerable attention is paid to aspiration systems. Aspiration systems must remove excess air from the equipment, creating a certain vacuum in them, as well as in sealing enclosures. In the case of feeding the product into silos and hoppers, the pneumatic conveying system should also take into account the volume of incoming air. It is undesirable to overestimate the volume of aspirated air, since it is uneconomical and, in addition, increases the speed in the cross section of air receivers, which leads to increased material carryover and deterioration of system performance, including an increase in loads on the dust collecting equipment [2].

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The degree of environmental impact of pollutants and the effectiveness of cleaning emissions depend on their properties, which in principle can be determined by the set of physic-chemical characteristics of all ingredients. However, there are significant difficulties that do not allow taking into account the totality of the processes occurring in a mixture of at least several substances. Therefore, usually only one or two main (by quantity or toxicity) contaminant is considered, and one is the most typical for given process conditions. Real processes are described by simplified mathematical models. For example, dispersed emissions with a low content of suspended particles, such as air with low dust content, products of combustion of gas, liquid and even low-ash grades of solid fuels, are considered as homogeneous. If the presence of suspended particles has a significant impact on the properties of emissions, then the dispersed and homogeneous parts of the aerosol are considered separately, as two independent systems. In this case, the homogeneous part is identified with the model of an ideal gas, and to describe the properties of the dispersed part, some mathematical models are used, for example, the normal or log-normal distribution of particle sizes. In technical calculations, homogeneous mixtures do not take into account the possibility of phase or chemical transformations, if they do not introduce obvious deviations in the properties of the system. This allows an ideal gas mixture model to be used for most homogeneous emissions.

The degree of the impact of pollutants on the human body depends on the enormous number of causes caused by the state of the organism itself, external conditions, the type of pollutant, and other factors. Very significant indicators are toxicity, concentration and exposure time of the pollutant. In the general case, it is generally accepted that long-term exposure to low concentrations is more dangerous than short-term exposure to concentrated substances, of course, if the dose received is not close to the lethal one [3].

According to their impact on the human body, industrial pollutants are divided into 4 hazard classes: I extremely dangerous, with lethal (medium lethal) doseLD50 entered into the stomach, less than 15 mg per 1 kg of live weight; II - highly dangerous, withLD_{50} = 15...150 mg/kg; III - moderately dangerous, with LD_{50}= 150...5000 mg/kg; IV -low hazard, withLD_{50}>5000 mg/kg. To some extent, it gives an idea of the danger of the polluter and the value of its maximum permissible concentration in the air of the working area MPCrz is usually attributed to the 1st hazard class of a substance with MPCrz <0,1 mg/m^3, to the P class - substances with MPCrz = 0,1. .. 1 mg/m^3, to class III - substances with MPCrz = I ... 10 mg/m^3 and to class IV - substances with MPCrz> 10 mg/m^3 [4].

II. METHODS OF RESEARCH

Dispersion of impurities in the atmosphere: Gaseous and dust impurities are scattered in the atmosphere by turbulent wind sweats. Accordingly, the transport mechanism of impurities is twofold: convective transport by averaged motion and diffusion by turbulent pulsations. Impurities usually seem to be passive in the sense that their presence does not have a noticeable effect on the kinematics and dynamics of the movement of flows. Such an assumption may be too coarse for large aerosol particles.

It is possible to create a device with a high degree of purification of emissions for a specific production process only on the basis of a full cycle of research, design and commissioning works, since production processes and their associated emissions are so diverse that existing standard solutions almost always require thorough refinement.

Carrying out detailed studies to determine emission parameters, identifying the dynamics of their change at different stages of the technological cycle is often beyond the power of developers of cleaning systems, which is why they have to use data from more or less similar processes. To eliminate the possibility of gross errors, it is necessary to first study the features of the production facility and the process as an emission source. Among a large number of factors that should be taken into account, we can single out a number of common and necessary in the development of cleaning devices [4].

The environmental impact of industrial and industrial enterprises is not positive, even if the ecological condition of industrial and industrial enterprises operating in the Republic of Uzbekistan is considered to be satisfactory. Smoke and dust, nitrogen and carbon monoxide formed from them cannot be considered within or within acceptable limits even after passing through the sewage treatment plant.

Therefore, it is advisable to implement a two-stage cleaning process to increase the efficiency of dust removal equipment. In industrial plants, dust is cleaned up to 85% and released into the atmosphere. With the use of gas cleaning equipment with the use of recommended absorbent mobile supplementary materials, a decrease in the content of pollutants in the atmosphere can be achieved by removing nitrogen oxides, carbon monoxide and other gaseous substances by 92-95%.

In artificial air pollution, road transport prevails by 40%, energy - by 20%, products of enterprises and organizations - by 14%, 26% of agricultural products, utilities and others. At present, it is estimated that about 500 million tons of

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greenhouse gases will be added to the atmosphere each year, tons of sulfur dioxide, sulfide, nitrous oxide, carbon dioxide. In addition, cement, coal, metallurgical and other industrial enterprises produce ash, zinc, lead, copper, powder and other solid modifications.
Atmospheric pollution is associated with mining and utilities. At the same time, gases, smoke, organisms, and gray are emitted into the atmosphere when different types of fuel are burned. Thus, 67% of sulfur emissions into the atmosphere result from combustion, 12% of crude oil and 13% due to the melting of copper.
Atmospheric air pollution with various heavy metals, industrial wastes and other substances ultimately endangers the life of living creatures in the biosphere and the earth in the biosphere. Such compounds in the air gradually settle to the surface and greatly inhibit the growth and development of plants. As a result, the root structure, morphological features, barley, leaves and flowers are slightly weakened, and they lag behind in growth and development. In some cases, the death of plants and animals is also observed.
For example, when the atmosphere contains high levels of toxic, evaporating gases and heavy metals: (fluorine, strontium, tin, and others), all living things experience difficulties. Sulfur dioxide, hydrogen, fluorine, ozone, chlorine and other compounds are extremely dangerous for the plant. In particular, they are extremely resistant to gases and heavy metals. For example, the Tajik Aluminum Plant has a negative impact on the growth and development of many grass varieties in Surkhandarya oak. Especially palm, cotton, pomegranate, figs, vegetables, (cabbage, onions, tomatoes, etc.), they don’t bear such attacks of grape or even tobacco.
Some of the harmful substances that are released into the biosphere will not be neutralized in the biological circulation and will not be destroyed for many years. Thus, the natural balance of gas, water and the geochemical order of the biosphere disturbed. There is a serious conflict between man and nature.
Accelerated development of the industry leads to a constant increase in pollution of the atmosphere and hydrosphere. The total waste of industry, agriculture and utilities is estimated worldwide at billions of tons per year.
The most important aspect of reducing emissions of industrial waste into the air base is the technology of the production process and the development of basic technological equipment. When choosing technological units, more aggressive units should be considered. For example, a blast furnace with a volume of 5,000 m3 replaces the modern blast furnace shop, and dust and carbon dioxide emissions are reduced only by reducing the sources of dust and gas.
Replacing fuel with electricity in production units significantly reduces dust and harmful gases.
The transition from batch processes to continuous processes can lead to a significant reduction in dust and gas emissions. For example, the transition from material to missed transportation to shops with internal drive will reduce dust separation several times. Providing technological units with anti-dust devices significantly reduces dust emissions into the atmosphere. For example, devices for coke ovens and optical oxygen fibers are examples of such devices. Also, condensation of raw materials that meet the technical conditions leads to lower emissions.

There are two ways to determine the amount of dust in the air:
1. Weight method.
2. The counting method.
The weighting method is widely used because it is convenient.
The following formula is used in determining the content of dust in the air by weight:

$$C = \frac{q_1 - q_2}{V_0} * 1000 \tag{1}$$

The whole weight of the dust is determined using a paper filter.
Where, C - the concentration of dust in the air, mg/m^3;
q_1 and q_2 - all filters before and after filtration of pollen, in mg;
V_0 - the amount of air passed through the filter, liter.
This air volume is determined by the following formula.

$$V_0 = \frac{273 * V_t * B}{(273 + t) * 760}, \ [м^3] \tag{2}$$

Where, **B** - barometric pressure, Pa (1 mm Hg, 133.322 Pa)
T - is the air temperature during sampling of dust, ^{0}C.
Vt - measurement of the device, the volume of air transmitted through the filter (liter) can be calculated as follows:

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$$V_t = t * v \quad , (3)$$

Where, V is the volume of air emitted through the filter, l/min. t is the time of the experiment, minutes.

Analytical methods for the determination of dust in the mill aspiration system NUEF 52/2400, NUEF 26/2400 at JSC "Jizzakhdonmahsulotlari" using a micro manometer.

Source-19: The aspiration system consists of 52 arm filters, power Q = 8000 m^3/h, fan T-25, height N = 24 m, diameter D = 0,.60 m.

Air pressure P = 735 mm, temperature T = 20 ° C, correction factor q = 0,90. Indicators of micro manometers before cleaning is equal to ΔP = 60, 50, 40

Using the indicators of the micro manometer, we determine the velocity of the gas of the air mixture by the following expression:

$V_1 = \sqrt{60} * 1,69 = 13,09$ m/s

$V_1 = \sqrt{50} * 1,69 = 11,95$ m/s $V_{sr} = 11,91$ m/s

$V_1 = \sqrt{40} * 1,69 = 10,68$ m/s

The source cross-sectional area is:

$$F = \frac{\pi * D^2}{4} = \frac{3,14 * 0,60^2}{4} = 0,282 \text{ м}^2$$

Determine the volume of gas air mixture discharged through the pipes as follows:

$Q = V_{cp} * F * 0,90 = 11,91 * 0,282 * 0,90 = 3,02$ m^3/s

Using an aspirator, we determine the amount of dust fraction in the air per unit of time:

$V_ч$= 10 l/min * 5 min = 50 liter =0,05 m^3

V_0= 0, 05 * 0, 90 = 0,045m^3

$$C = \frac{\Delta Q}{V_0}, \text{ mg/m}^3 \quad C_1 = \frac{3,61}{0,045} = 80,22 \text{ mg/m}^3$$

$$C_2 = \frac{2,92}{0,045} = 64,88 \text{ mg/m}^3 \qquad C_3 = \frac{4,2}{0,045} = 93,33 \text{ mg/m}^3$$

$C_{cp.}$= 79,47 mg/m^3

B = 79,47 * 3,02* 0,001 = 0,2399 g/s

Indicators of the micro monometer after cleaning is equal to: ΔP = 30, 20, 10

Using the indicators of the micro manometer, we determine the velocity of the gas of the air mixture by the following expression:

$V_1 = \sqrt{30} * 1,69 = 9,25$ m/s

$V_1 = \sqrt{20} * 1,69 = 7,55$ m/s $V_{cp.} = 7,38$ m/s

$V_1 = \sqrt{10} * 1,69 = 5,34$ m/s

The source cross-sectional area is:

$$F = \frac{\pi * Д^2}{4} = \frac{3,14 * 0,60^2}{4} = 0,282 \text{ m}^2$$

Determine the volume of gas air mixture discharged through the pipes as follows:

$Q = V_{cp} * F * 0,90 = 7,38 * 0,282 * 0,90 = 1,873$ $м^3$/c

Using an aspirator, we determine the amount of dust fraction in the air per unit of time:

$V_ч$= 15 l/min * 5 min = 75 liter= 0,075 m^3

V_0= 0,075 * 0,90 = 0,0625 $м^3$

$$C = \frac{\Delta Q}{V_0}, \text{ mg/m}^3 \quad C_1 = \frac{1,2}{0,0625} = 17,77 \text{ mg/m}^3$$

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$$C_2 = \frac{1,3}{0,0625} = 19,25 \text{ mg/m}^3 \qquad C_3 = \frac{1,1}{0,0625} = 16,29 \text{ mg/m}^3$$

$$C_{cp.} = 17,77 \text{ mg/m}^3$$

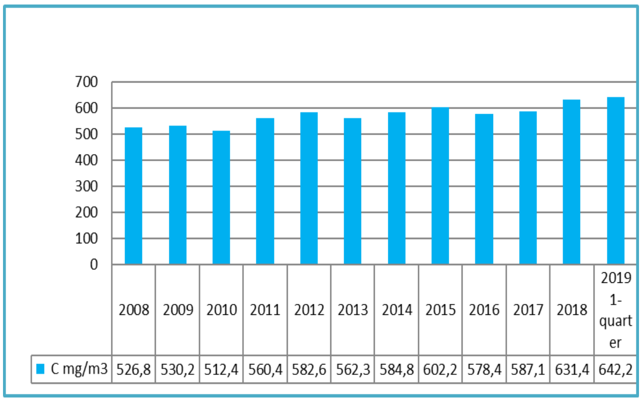
$$B = 17,77 * 1,873 * 0,001 = 0,03328 \text{ g/s}$$

$$\eta = \frac{0,2399 - 0,03328}{0,2399} * 100 = 86,13\ \%$$

Table 1. There are analyzed the concentration of dust grain in the air in the elevator shop before and after cleaning:

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	1 sq.2019
The concentration of grain dust in the air is cleaned in the elevator												
C mg/m^3	526,8	530,2	512,4	560,4	582,6	562,3	584,8	602,2	578,4	587,1	631,4	642,2
Grain dust concentration in the air after cleaning in the elevator												
C mg/m^3	72,4	74,2	68,3	76,8	80,4	74,3	82,1	88,2	81,6	89,2	91,3	93,3

From table no. 1, it can be seen that the grain dust concentration in 2008 is 526,8 mg/m^3 before cleaning, and after cleaning the dust collection unit is 72,4 mg/m^3. The effectiveness of the dust filter is 86,2%. In 2010, before cleaning, 512,4 mg/m^3, after cleaning with a dust collection unit, make up 68,3 mg/m^3. The effectiveness of the dust filter is 86,6%. In 2014, before cleaning, 584,8 mg/m^3, after cleaning with a dust collection unit, they are 82,1 mg/m^3. The effectiveness of the dust filter is 85,9%. In 2018, before cleaning, 631,4 mg/m^3, after cleaning with a dust removal unit, they are 91,3 mg/m^3. The efficiency of the heater is 85,5%.



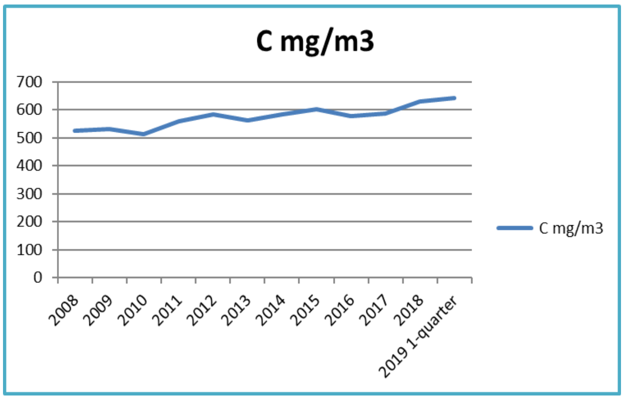


Fig.1. Grain dust concentration before cleaning in the **Fig. 2.** Grain dust concentration before cleaning in the Elevator

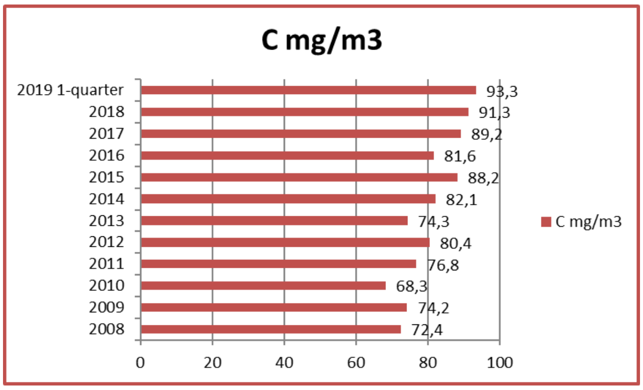


Fig.3. Grain dust concentration after cleaning in the elevator

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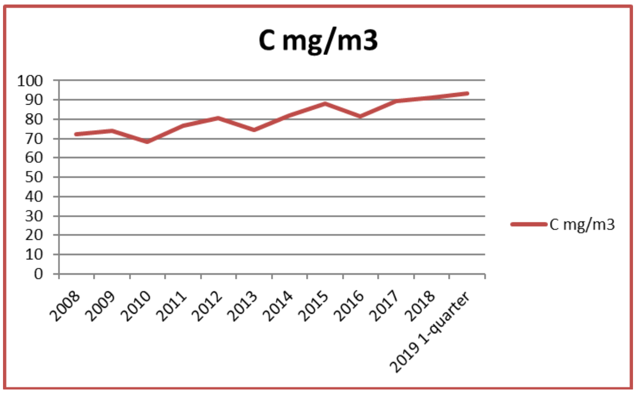
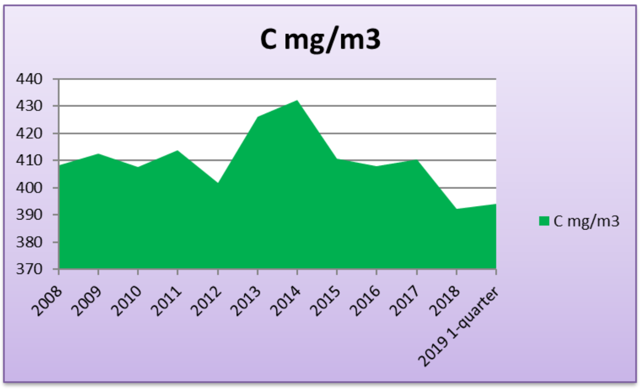


Fig.4. Grain dust concentration after cleaning in the elevator

Table 1. The concentration of feed dust in the air in the feed shop before and after cleaning

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	1 sq 2019
The concentration of feed dust in the air before cleaning in the feed mill												
C mg/m^3	408,2	412,6	407,5	413,7	401,6	426,2	432,3	410,8	407,8	410,3	392,2	394,2
The concentration of feed dust in the air after cleaning in the feed shop												
C mg/m^3	48,2	46,3	50,7	48,3	46,1	52,4	54,6	51,4	49,2	47,8	55,3	50,2

In 2008, the concentration of the compound feed dust is 408,2 mg/m^3 before cleaning, and 48,2 mg/m^3 after cleaning with a dust collection unit. The efficiency of the dust filter is 88,2%. In 2010, before cleaning 407,5 mg/m^3, after cleaning with a dust collection unit, they are 50,7 mg/m^3. The effectiveness of the dust filter is 87,5%. In 2014, before cleaning, 432,3 mg/m^3, after cleaning with a dust collection unit, it was 54,6 mg/m^3. The effectiveness of the dust filter is 87,4%. In 2018, before cleaning, 392,2 mg/m^3, after cleaning with a dust collection unit, they are 55,3 mg/m^3. The effectiveness of the dust filter is 85,9%.



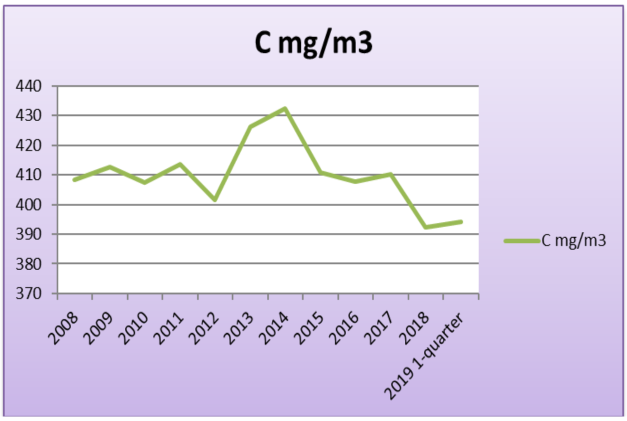


Fig.5. Concentration of the dust from the feed mill before cleaning in the feed mill

Fig.6. Concentration of the dust from the feed mill before cleaning in the feed mill

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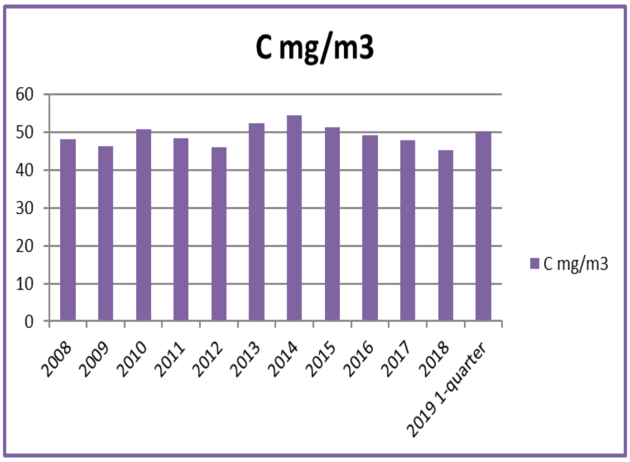


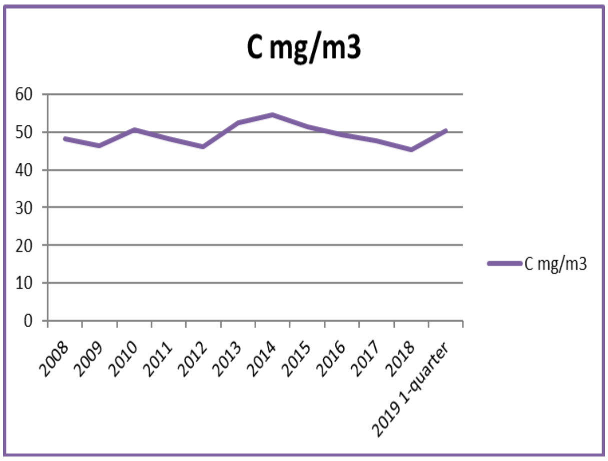
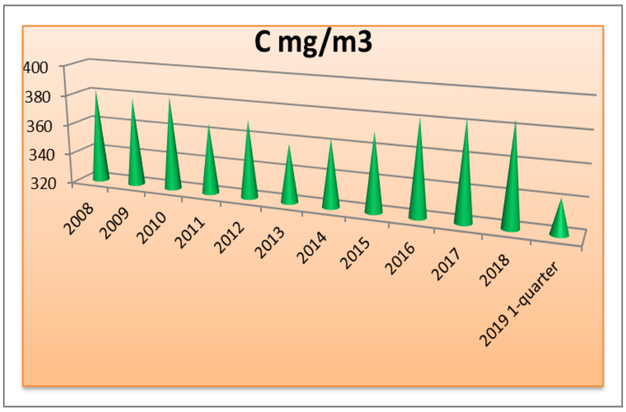


Fig.7. Concentration of feed dust after cleaning in the feed mill **Fig.8.**Concentration of feed dust after cleaning in the feed mill

Table 3. The concentration of flour dust in the air in the mill before and after cleaning

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	1 sq 2019
The concentration of dust flour in the air before cleaning in the mill												
C mg/m^3	382,4	378,4	381,8	366,2	371,2	358,2	364,2	371,3	382,8	384,3	386,2	382,4
The concentration of dust flour in the air after cleaning in the mill												
C mg/m^3	38,8	34,4	36,4	33,1	35,2	34,3	43,2	36,3	37,3	35,3	42,4	37,0

The concentration of flour dust in 2008 was 382,4 mg/m^3 before cleaning, after cleaning with a dust collection unit 38,8 mg/m^3. The effectiveness of the dust filter is 89,9%. In 2010, before cleaning, 381,8 mg / m3, after cleaning with a dust removal unit, they make up 36,4 mg/m^3. The efficiency of the dust filter is 90,5%. In 2014, before cleaning, 364,2 mg/m^3, after cleaning with a dust removal unit, they were 43,2 mg/m^3. The efficiency of the dust filter is 88,1%. In 2018, before cleaning, 386,2 mg/m^3, after cleaning with a dust removal unit, they are 42,4 mg/m^3. The effectiveness of the dust filter is 89,0%. The efficiency of the dust catchers decreases for the year, due to the obsolescence of the installation and the air ducts.



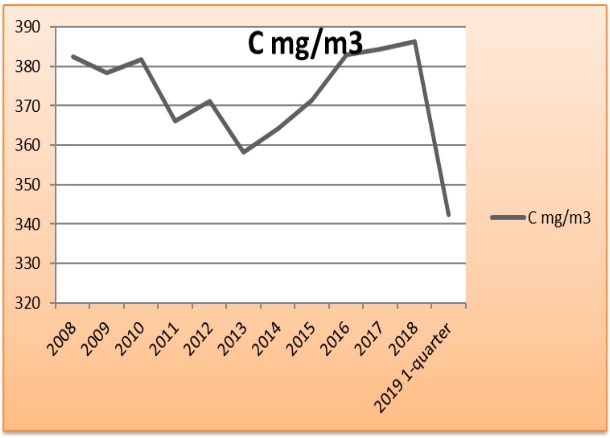


Fig.9. Concentration dust flour before cleaning in a mill **Fig.10.** Concentration dust flour before cleaning in a mill

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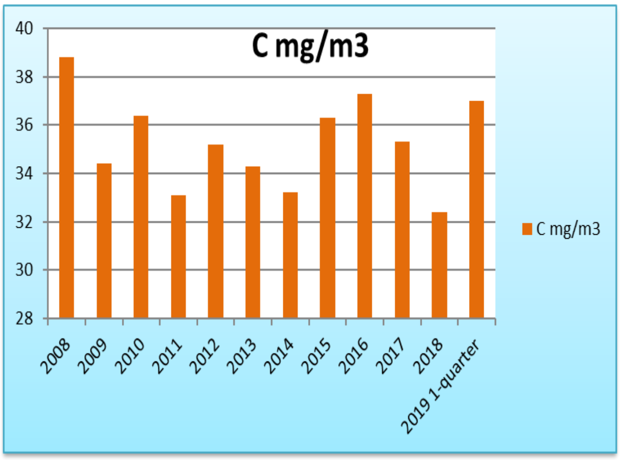

Fig.11. The concentration of dust flour after cleaning in the mill

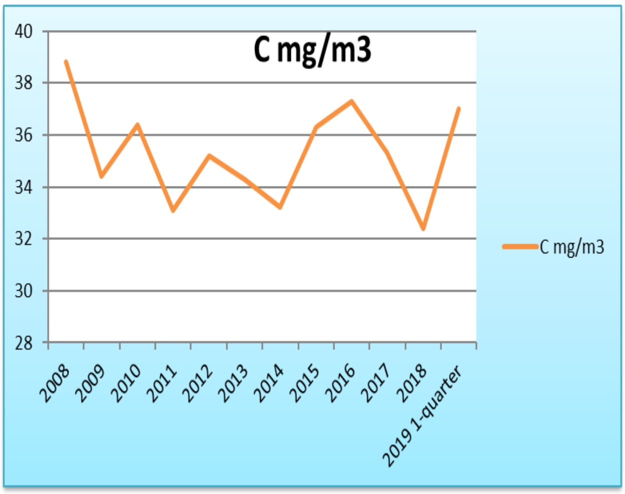

Fig.12. Concentration dust flour after cleaning in the Mill

III.CONCLUSION

Consequently, results of the analysis show that the efficiency of dust removal at industrial enterprises has decreased. It is possible to increase the efficiency of existing dry mechanical dust collectors, that is, to install additional filters or to install modern electronic filters.
The main direction of reducing emissions of industrial waste is the process of production processes and the improvement of the main process equipment. When choosing technological units, more aggressive units should be considered. New forms of energy using alternative energy can also reduce the amount and amount of pollutants released into the environment.

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