Ecological aspects of the neutralization of gas emissions leaving from the resin storehouse of Joint - stock company "Zaporozhkoks"

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Abstract
Analysis of the neutralization methods of gas emission leaving from the resin storehouse of Joint - stock company "Zaporozhkoks" is presented here. It is stated that the aluminium-nickel-palladium catalyst is needed for gas emission neutralization. The scheme of the gas-purifying device is presented, its work is described. The degree of benzene neutralization has formed 94%, phenol 96%.
Keywords: COKE, LEAVING GASES, CATALYTIC NEUTRALIZATION, DEGREE OF PURIFICATION

The cast iron and steel production occupies important place in economy of Ukraine. Metallurgical branch of industry does not only completely satisfy the need of home market, but also is one of the largest exporter of its product. Considering significant volumes of cast iron and steel production, it is impossible to ignore the influence of metallurgical production on environment. Chemical-recovery production occupies not the last place on ecological pressure. Thereby, reduction of materials, emitted in atmosphere formed during coke production, is an actual problem.

At present coke is irreplaceable part of charge of blast-furnace production. The raw materials for production of coke are special sorts of coal. The whole process consists of three stages: preparation to coking, coking proper, catching and conversion of the flying products.

Preparation comprises enrichment and crushing of coal for their averaging on composition and coarseness. Sometimes mixing of different types of coal is needed.

Prepared charge is loaded in camera through special holes. The stove is heated through lateral surfaces (which walls are lined with firebricks) for account of gas burning. At the average, the process occupies 14-16 hours and occurs at the temperature 900-1200°C. Then agglomerated layers of coke are extracted from stove by coke pushers and cooled (put out) by water or inert gas.

The gas, extracting while coking, falls into gas collector, and leads then through gas pipeline up to air and water refrigerators . At the point cooling and condensation occurs, formed mixtures of water and resin are led in concrete or iron reservoirs. In reservoir resin-water mixture is subjected to settling with the result of receiving of tar water and resin directly [1]. Soaking pipe, equipped by pump, is led to the lower part of reservoir for settling. By means of the pipe resin is pumped out into special tanks – storages, whence it comes for the further conversion.

Since resin must be in viscous condition, reservoirs are warmed constantly, mainly by steam. The temperature of the maintenance of the resin in condition suitable for conversion is found within from 70 up to 80 °C. At such temperature the separation of flying forming of resin occurs, presenting toxic material itself and requiring neutralization before emission in atmosphere. The averaged composition of emissions from storehouse of resin is presented in tabl.1 [2].

Table 1. Composition of the main emissions of the place of resin storage of Joint - stock company "Zaporozhkoks"

№	Name of material	Emission concentration мg/м^3	MPC, мg/м^3
1	Ammonia	100	0,2
2	Hydrogen sulfide	130	0,008
3	Cyanic hydrogen	20	0,01
4	Phenol	1200	0,003
5	Benzene	100	0,8
6	Naphthalene	350	0,003
7	Benzpyrene	0,00182	0,1 мкг/100 м^3

At analysis of the given data, considering toxicity of emission, it's needed to draw attention on neutralization of phenol, benzene and benzpyrene.

Proceeding from above stated composition of eliminated, volume of deleted gas the most acceptable methods for its neutralization are: 1) adsorptive method; 2) absorptive method; 3) method of thermal after-burning; 4) catalytic method.

Adsorptive method is one of the wide-spread means of air protection. It is based on absorption of the admixtures by solid bodies with developed surface - adsorbents. The main industrial adsorbents are activated carbons, complex oxides and impregnated sorbents. Activated carbon is neutral to polar and non-polar molecules of adsorbed combinations. Its selectiveness is less than many other sorbents, and it's one of the few suitable to functioning in humid gas flow. Oxide adsorbents possess more high selectiveness as related to polar molecules because of their own dissimilar sharing of the electric potential. Their disadvantage is a reduction to efficiency in presence of moisture. Adsorptive methods using allows us to bring back into production the number of valuable compounds. Their main defects come to big duty of desorption stage and the following division that vastly complicates its using for multi-component mixtures, small velocity of purification, impossibility to clean the dust-laden gases.

Absorptive emission clearing is used both for extraction of the valuable component from gas and for sanitary gas cleaning. Absorptive processing is used for discharge, which pollutants are well dissolved in absorbent. It's reasonable to use the given method if the concentration of the extracted component in gas flow is over 1%. Absorption is the most wide-spread process of gas mixtures clearing in many branches. It's used for emission clearing from hydrogen sulfide, other sulfury compounds, vapor of sulfuric and hydrochloric acids, cyanic compounds, organic matters (phenol, formaldehyde and others). As absorbent water or organic liquids, boiling under high temperature, are mostly used. The defects of the method are high cost of clearing, additional expenses on regeneration of absorbent, necessity of significant production areas for organization of gas purification process.

The method of thermal after-burning is based on high-temperature (700-1200°C) burning of bad admixtures, contained in gas emission [3]. It is used firstly under high concentration of admixtures and significant contents of oxygen. The process of the thermal oxidation of leaving gases under low temperature is power-hungry, since it requires use of additional fuel for gases heating to high temperature. As a rule, admixtures are burned in stoves with use of gaseous or fluid fuel. Installations are rather simple as constructions, occupy small area. Their efficiency does not depend on lifetime. The defects of the thermal neutralization are: formation of nitrogen oxides in process of high-temperature burning, significant fuel consumption.

The catalytic methods of gas purification are versatile. They allow us to convert harmful gas admixtures into harmless, less bad or removable [4]. The method enables to process multicompound gases with low concentration of harmful substances, obtain high cleaning degree, lead the process continuously, avoid secondary pollutants formation. The catalytic methods are founded, as a rule, on heterogeneous catalysis, which processes run on surfaces of solid bodies - catalysts. The feature of catalytic processes lies in the fact that they run under small concentration of the deleted admixtures. The main merit of the method is that it gives the high cleaning degree, but its defect is formation of new, not always harmless materials, which must be eliminated from gas by other methods.

Thereby, basing on the above mentioned analysis of existing ways of toxic gaseous emission neutralization, it's reasonable to use the catalytic method for leaving gases neutralization on the area of resin keeping.

On the area of "Zaporozhkoks" resin storehouse this method is realized as follows. The installation of catalytic gas neutralization includes two catalytic devices (the reactors), connected parallel, and traction-blow device. The scheme of the installation is presented in fig 1.

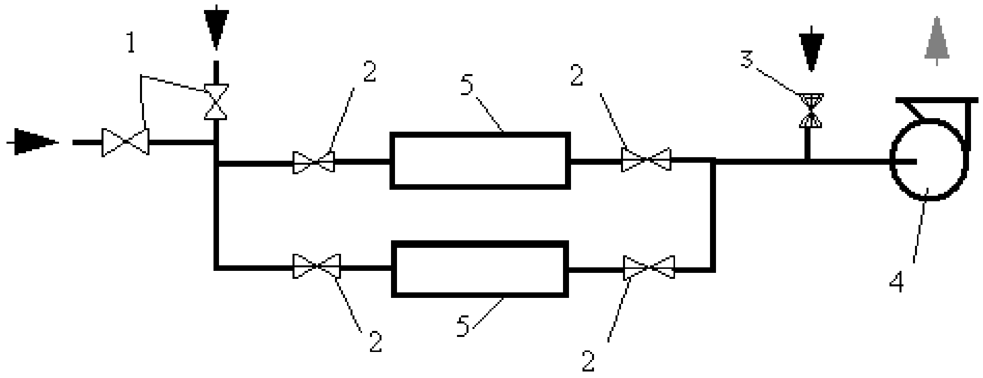

Figure 1. The scheme of the installation of gas emission neutralization of resin storehouse valve DHO-150; 2- valve DHO-200; 3- valve DHO-350; 4- traction-blow device; 5- catalyst case (reactor) KR1-ZY-01

The installation works as follows (refer to fig.2). Emissions, cleaned beforehand on absorptive installations, enter catalytic reactor (1), where they get through tubular heat exchanger (2). At that their temperature increases up to the temperature 200-250°C. After heat exchanger gas moves to the zone of electric heating elements (3), where it is warmed up to the temperature 350-450°C. This temperature is sufficient for quick passing of chemical reactions of oxidation of aromatic hydrocarbon by means of aluminium-nickel-palladium catalyst. In layer of the catalyst the reaction of hydrocarbon oxidation of air-gas mixture occurs till practically harmless dioxide carbon and water. After catalyst refined hot gas enters newly on heat exchanger on external part of pipe space and, cooling, is removed in gas-outlet tract of the installation.

Thereby, use of the catalytic way of gas neutralization leaving from the area of resin storage allows us to reduce the concentration of the phenols on 96 %, benzene on 94%, benzpyrene on 53%, that corresponds to the installed rate of emissions.

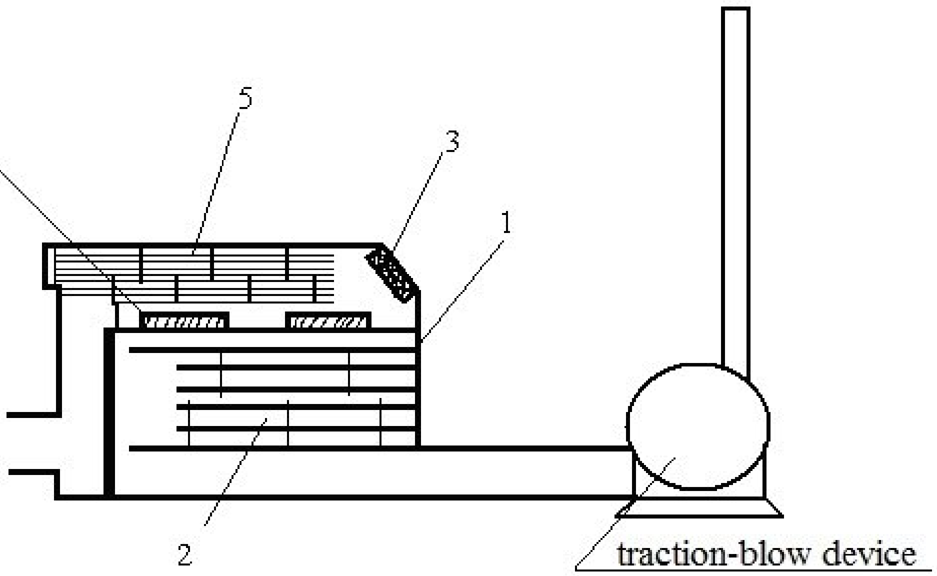

Figure 2. Structure of catalytic KR1-ЗУ-01 body; 2-tubular electric heating unit; 3- heat-exchange pipe; 4-element with catalyst; 5-cover.

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