УДК 502.654

DUST CAPTURE EFFICIENCY OF DRYING DRUMS IN THE PRODUCTION OF ASPHALT CONCRETE MIXTURES

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Emissions of pollutants into the atmosphere is considered to be the key factor among the enterprises in the sphere of building and constructing that has an impact on environment.

Factories that produce cement, asphalt concrete, reinforced concrete structures, silica bricks, expanded clay, and also factories that process nonmetallic materials are the main sources of air polluting with dust, hydrocarbons, soot, carbon monoxide, nitrogen oxides and other harmful impurities. In this case, not only dust emissions from technological equipment and processes has an impact on the environment, but also from stationary and fugitive sources of emissions.

Emissions through the vacuum-cleaning system during the process of making asphalt concrete mixtures and emissions from bitumen melting furnace Are considered to be stationary source of emissions.

Due to the functioning of asphalt concrete factories at all stages of producing the asphalt concrete mixture, in both batch-type and continuous-type equipment, it is possible to observe polluting the air with harmful substances and dust.

The major impact on the emissions of harmful particles into the atmosphere has the following technological operations: loading-unloading activities as well as motor vehicle operation; storing of mineral materials; loading mineral materials into a tank and their transportation; crushing and screening plant operation; storing and loading ready-made mixtures on motor vehicles; a set of technological operation, namely, accepting, storing, keeping the working temperature (app. 140 ºC) and supplying bitumen into a dosing chamber; drying and mixing stone materials and making asphalt concrete mixtures; supplementary technological operations (such as maintenance, welding, storing and movement of vehicles at the site).

During the operation of any asphalt concrete factory, the following impurities are emitted into the atmosphere: non-organic dust with the different level of silicon dioxide; carbon monoxide and nitrogen oxide; sulfur dioxide; saturated hydrocarbons (also known as paraffins); polycyclic hydrocarbons: fuel oil ash (in terms of vanadium) when using residual oil as a fuel.

The volume of dust pollutions emitted from technological equipment of different types varies in wide ranges depending on the operation mode and processing rate of the factory.

The maximum level of dust is emitted during the drying and heating the mineral materials up to the required temperature in a dying drum (180-200 °C) [1].

Drying drums consist of a spinning drum, furnace unit with a nozzle, fuel supply and heating system, fuel tanks and a dust cleaning system. Liquid fuel, such as fuel oil, or gas are mainly used. Fuel oil is necessary to heat up to 70-100 °C before supplying into nozzle.

In a drying drum stone materials are dried and heated up to20-30 °C higher the required given temperature of the mixture. The materials are heated by means of backflow. Drying drum is mounted with the axle slopping towards the furnace unit, and loading of the material is performed through the special loading mechanism at the opposite end of the drum. Inside the drum there are special shelf that is used to improve the mixing process. Due to the axle sloping, material is poured from shelf to shelf and simultaneously moves to the furnace unit, being well mixed and ventilated by hot smoke fumes [2].

When drying and heating sand and crushed stone, a large amount of fine and coarse fractions of dust, as well as unburnt soot particles are emitted into the atmosphere. The amount of emitted particles from the drying drum depends on the granular size and type of fuel used. Emissions in the absence of suppression is an average 20kg/t of material. Emissions are coarse particles, the size of over half of those is more than 20mkm and depends of the material used.

That is why, smoke fumes, coming out of a drying drum, are purified with the help of different dust-cleaning systems that are designed to create minimum depression in a drying drum in order to direct the whole flow of contaminated gases into a dust collector. The cleaning efficiency in this collector is 99.2%.

As a rule, dust-cleaning system has two stages. At the first stage dust dry-cleaning separators installed in groups are used; at the second stage wet dust collector is applied.

When installing wet dust collectors, it should be taken into account that the temperature of smoke fumes is slightly decreasing and when the calculations of dissipation are performed once again, it is required to state the fumes temperature taking into account the decreasing in a wet collector.

As a rule, dust collecting systems of drying drums consist of separators CN-15 (ЦН-15) or SCN-40 (СЦН-40) [2, 3]. There separators clean dust and gas particles sized more than 20 mkm. Small particles sized less than 20 mkm are collected with low efficiency.

Drying drum emissions can also be captured either by scrubbers or by bag filters that has separators in front of them. Such devices decrease emission for more than 99% [3].

Therefore, the conducted analysis of structures and technical characteristics of separate elements of dust-cleaning systems allows the authors to note the following:

– with a relation to maximum efficiency, reliability, simplicity of operation, it is possible to apply vortex inertial dust collectors that provide high capturing capacity of different dispersability, have low sensitivity to load fluctuations in the air and to dust concentration in a air flow being purified.

– besides, it is possible to take into account the applying of modernized separator, namely, filter.

References

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