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TECHNICAL AUDIT OF MELT GRANULATION UNITS IN THE PRODUCTION OF MINERAL FERTILIZERS BY THE TOWER METHOD

In recent years, some results of studies of coherent particle flows (for example, droplets or granules) have been widely discussed in scientific publications [1]. The interest in such structures is both fundamental and related to the development and creation of monodisperse technologies [2].

In modern chemical production, the use of coherent systems is implemented, in particular, in large-scale production of nitrogen and complex mineral fertilizers obtained by the tower method (prilling).

Various types of technical devices are used to form drip structures. Currently, the most promising method is the forced capillary decay of liquid jets using rotating or static vibrating granulators (VVG) [3].

The prilling tower is an engineering and technical structure with a height of 30-114 m and a diameter of 8-24 m, depending on the performance and physico-chemical properties of the products obtained with a built-in or remote pellet cooling device in the "fluidized bed", with air ducts, fans for supplying air to the cooling device and removing it from the tower [4].

A significant factor affecting the operation of the granulation tower is the thermal load, which in particular depends on the monodispersity and diameter of droplets (granules). In summer, the ambient air temperature is high, therefore, in order to reduce the thermal load of the tower, with constant air flow through it, it is recommended to reduce the diameter of the granules obtained, in winter it is advisable to increase the size of the droplets. For example, to obtain carbamide with an average particle diameter of 2.1 mm at an air temperature of 25-35 ° C, the required tower height is 64.4–67.9 m, whereas at air temperatures below 0 ° C, it is possible to obtain granules with a diameter of 2.3–2.5 mm, with fixed air flow rates.

Based on the factory conditions of mineral fertilizers production, the flow rate of the melt entering the granulator body is not constant, which leads to a change in its level in the VVG basket and, as a consequence, the flow rate of the liquid and the diameter of the resulting droplets.

So, for example, when the air flow through the tower is about 300,000 m3/ hour and the dust content in it 200-250 mg/m3, the AS-60 ammonium nitrate production unit annually emits more than 1,500 tons of product into the atmosphere [6]. In addition to the economic aspect associated with product losses, this problem also has an environmental one — pollution of the air basin, the ingress of fertilizers into surface and groundwater, the accumulation of nitrites and nitrates in plants and reservoirs, which leads to a load on the ecosystem.

Thus, the purpose of this work is to study (on an experimental setup) the influence of the parameters of the forced signal generated by the generator and the liquid level in the volume of the apparatus on the uniformity of the droplets formed during the disintegration of the jet by the method of forced disintegration of liquid jets. The obtained results will complement the theoretical research and will become the basis for the design of a special frequency generator, which will be used in the modernization of existing granulators in large-scale production of nitrogen fertilizers.

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