International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 03 ISSUE 04 Pages: 66-71
SJIF IMPACT FACTOR (2021: 5.478) (2022: 5.636) (2023: 6.741)
OCLC – 1368736135
Crossref doi Google Scholar WorldCat MENDELEY
ISSN-2750-1396

Journal Website: http://sciencebring.com/index.php/ijasr

Research Article

IMPROVEMENT OF THE EXISTING INTERNAL HEAT EXCHANGE PROCESS IN MODERN BELT DRYERS

Submission Date: April 18, 2023, **Accepted Date:** April 23, 2023,
Published Date: April 28, 2023
Crossref doi: https://doi.org/10.37547/ijasr-03-04-09

Eldorbek Koraboev
Assistant, Fergana Polytechnic Institute, Ferghana, Uzbekistan

ABSTRACT

Different designs of dryers have been created on the basis of the general rules of providing external energy during heat treatment of dispersed materials, which have their own advantages and disadvantages. One of the promising methods of accelerating the drying process of dispersed materials is the use of belt dryers. One of the main advantages of devices that work in this way, called belt dryers, is the simplicity of the mechanical devices that move inside them, which increases the accuracy of the dryer. The small dimensions allow us to save a lot of rare stainless steel used for their production. Due to the heat applied to the belt dryers, the dispersed material undergoes intensive thermal processing, and its processing is fast. In this way, the contact time of the dispersed material and the heating surface is formed, and the efficiency of the contact drying process increases many times.

KEYWORDS

Dryer drum, distribution degree, average residence time, load degree, fall length, mineral fertilizer.

INTRODUCTION

It can be achieved by using the energy of hot gases more fully to accelerate the processes of heat and mass exchange between the gas and solid phase in the drying drum. The solution to this problem is to increase the contact surface and time between the gas and solid phase. Among the various options considered, the following are the most important. Another interesting that about multi-belt machine one of the drums is driven by an electric motor, and the second is an assistant. Wet material is fed to one end of the belt and dry material is separated from the other end of the belt. The drying process is carried out using hot air or smoke gases [1,2,3].

ANALYTICAL RESEARCH METHOD

In the global chemical industry, scientific research is being carried out on the production of high-performance types of mineral fertilizers, ensuring drying based on high-quality and energy-efficient technology. In this regard, analysis of drying devices and modes, identification of problems; elimination of re-drying of a large part of the product by optimizing the grainy composition of the product; special attention is paid to the experimental research of the effect of the construction and placement of the internal nozzles of the drying apparatus on the direction of movement of the product and thermal aerodynamics. Drying costs account for 20% of the costs of the entire chemical industry. Currently, in modern chemistry, petrochemical and other industries, various technological processes are used in the processing of raw materials with radically different physical and chemical properties. The production of products that meet the requirements of the time and are easy to use, with improved content, is considered one of the factors that determine the importability of the product. In particular, improving the quality indicators of mineral fertilizers necessary for agriculture, granulation at the level of demand, transportation and delivery to consumers will ensure the economic growth of the enterprise and the stabilization of the work regime. However, the grain quality of the mineral fertilizers produced recently is not satisfactory, causing some difficulties during the use of the fertilizer and its application to the ground. This, in turn, reduces the product's quality [4,5,6,7].

The process of dehydrating wet materials using a drying agent is called drying. In this process, moisture passes from the composition of the solid phase to the gas phase by evaporation. Materials can be dehydrated in three different ways: mechanical, chemical and thermal. Mechanical dehydration is used for materials containing a large amount of water. In this method of dehydration, the moisture is removed by compression or centrifugal force in centrifuges. Mechanical dehumidification is usually the first step in dewatering materials. After mechanical dehydration, another part of moisture remains, which is removed with the help of heat, that is, with a drying wheel.

Heat-induced dehydration (drying) is widely used in the chemical industry. Drying is considered the last process of most productions, i.e. before obtaining a finished product. The most effective of the above-mentioned methods is dehydration under the influence heat materials. Due to the fact that, complete drying can be achieved during the drying process. Heat drying

International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 03 ISSUE 04 Pages: 66-71
SJIF IMPACT FACTOR (2021: 5.478) (2022: 5.636) (2023: 6.741)
OCLC – 1368736135
Crossref doi Google Scholar WorldCat MENDELEY
ISSN-2750-1396

of wet materials is the most common method in industry. This method is used in chemical, food and a number of other technologies. The moisture content of the material is initially removed by a cheap, mechanical (for example, filtering) method, and the final, complete dehydration is carried out by the drying method. Such a combined method of dewatering is economically efficient [8,9,10].

Drying is carried out in two ways (natural and artificial). Dehydration of materials in the open air is called natural drying, this process takes a long time. In the chemical industry, artificial drying is used to dehydrate materials, this process is carried out in special drying devices. Materials that need to be dried are divided into three types: solid (granular, fragmented, particulate); pasty; liquid (solutions, suspensions). According to the method of interaction of the heat-carrying agent with the material being dried, drying is divided into the following types:

1) convective drying — the wet material and the drying agent are directly mixed with each other;
2) contact drying — there is a wall separating them between the heat-carrying agent and the wet material;
3) radiation drying - heat is spread through infrared rays;
4) dielectric drying - the material is heated in a high-frequency current field;
5) sublimation drying - the material is frozen and dehydrated under a high vacuum.

The last three methods are used relatively little in industry and are usually considered special drying methods. Regardless of the type of drying, during the process, the material interacts with a moist gas (mostly air). Air, gas or steam can be used as a heat carrier. According to the value of the pressure in the drying chamber, there are atmospheric and vacuum dryers. There will be periodic and continuous devices for organizing the process. The material to be dried is granular, powdery, pasty or liquid. Natural or forced circulation is used to generate the pressure of the drying agent. When granular materials are used, the layer is dense, expanded, abstract boiling, fountain formation [11,12]. The drying agent is heated by steam, hot water, fire heaters or electricity. Various options for the drying process are widely used: removing the used drying agent from the apparatus, reusing the drying agent, heating the drying agent between the drying chambers, distributing the drying agent to the drying chambers, additionally heating the drying agent in the drying chamber, use of alternating heat field (sequential exchange of hot and cold air to the material layer) and so on. It should be noted separately that the wet material being dried in any drying method interacts with hot air in most cases. The effect of hot air on wet material is very important for this process. Therefore, knowledge of the main properties of moist air is necessary for studying and calculating the drying process. In chemical, food and other industries, other than the simplest drying process, such as air heating and passing through a drying chamber, can be organized using other methods. The scheme of air drying with intermediate heating is presented.

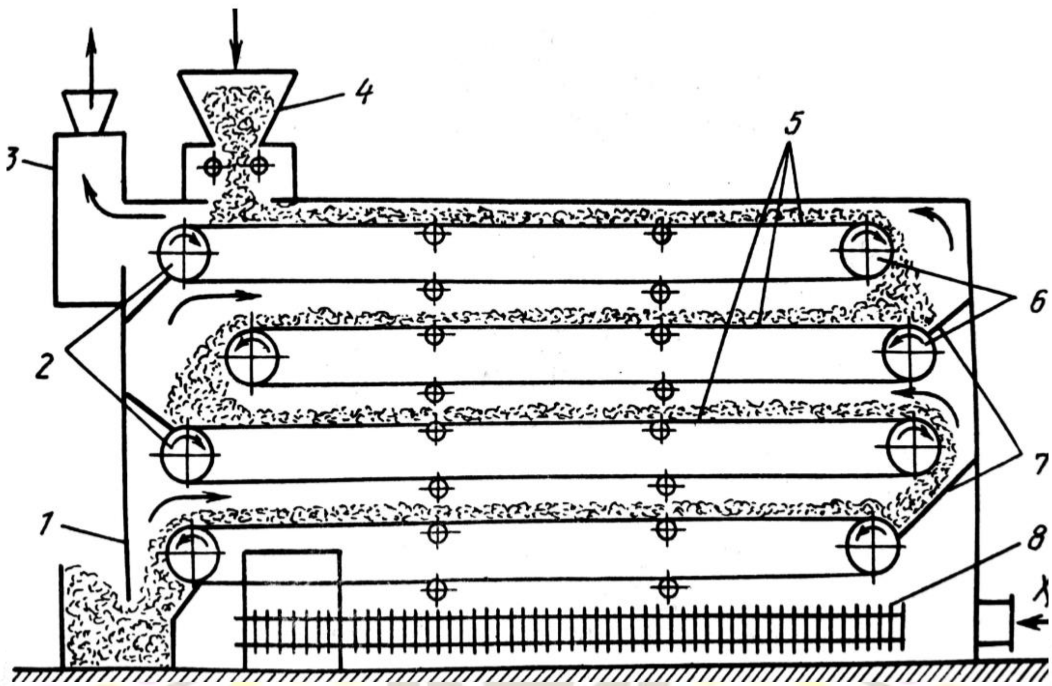

Figure 1. Belt dryer

1 – dryer shell; 2 – leading drums; 3 – ventilator; 4 – loading funnel; 5 – tape; 6 - leading drums; 7 - obstacles; 8 – heater.

MATERIAL SPRAYS DRYERS

Such devices are used to dehydrate solutions of mineral salts, dyes, liquid food products, enzymes and similar materials. Dryers of this type consist of a hollow cylindrical apparatus with a diameter of 5 m and a height of up to 8 m, on the upper part of which the material to be dried is sprinkled and the drying agent (hot, air and smoke gases) moving in parallel flow) collides with, as a result, moisture evaporates at a high speed. In spray dryers, the specific evaporation surface is large, so the drying process takes a short time (about 15-30 s). Since drying takes a short time, the process is carried out at low temperatures, resulting in a quality powder product. If the wet material is pre-heated, a cold drying agent can be used. Mechanical and pneumatic nozzles and centrifugal discs (4000-20000 revolutions per minute) are used to spray the material. In the spray dryer, the wet material is sprayed into the drying chamber using a nozzle. The drying agent is supplied to the device through the heater with the help of a fan, which moves in parallel with the material inside the chamber. The time the material stays in the drum is inversely proportional to the change in drum rotation speed.

International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 03 ISSUE 04 Pages: 66-71
SJIF IMPACT FACTOR (2021: 5.478) (2022: 5.636) (2023: 6.741)
OCLC – 1368736135
ISSN-2750-1396

In particular, we have simplified the movement of particles in the drying drum, based on the physical model of the device, taking into account several factors and proposed a unified model consisting of a flow zone, a stagnant zone and a recirculation loop of ideal mixing.

$$\bar{\tau} = (1+R)\left[\frac{M_1}{(1+R)\nu} + \frac{\beta M_2}{\beta(1+R)\nu}\right] = \frac{M_1+M_2}{\nu} = \frac{M}{\nu}, \qquad (1)$$

According to the form, M is the total mass of the layer, M1, M2- respectively, the mass of the material in the flow and stagnant zones, kg; n - mass flow rate at the inlet and outlet of the device; R(n) is the mass velocity of the circulating recycle flow, where R is the parameter of the recycle; b(1 R) n is the mass flow rate of a part of the flow coming to or leaving the stagnant zone; b is exchange intensity, 0≤b≤1.

Therefore, it can be seen that the average residence time of particles in the system does not depend on the exchange rate between the flowing and stagnant zones or the fraction of recirculation. The residence time predictions using the above equations from the literature under different operating conditions are were compared with the experimental data obtained for the operating rotary dryer and are presented in the results section

CONCLUSION

According to the information, belt dryers are widely used in industry. In belt dryers, the drying agent is oriented perpendicular to the wet material. As the material falls from one belt to another, its contact surface with the drying agent increases. Various options for the drying process can be organized in such dryers. Wet material is fed to one end of the belt and dry material is separated from the other end of the belt. The drying process is carried out using hot air or smoke gases. Dryers of this type are single or belt. For that reasons we decided to improve their internal dry process.

REFERENCES

1. Axunboev, A., Muxamadsodikov, K., & Qoraboev, E. (2021). Drying sludge in the drum. Barqarorlik va yetakchi tadqiqotlar onlayn ilmiy jurnali, 1(5), 149-153.
2. Тожиев, Р. Ж., Миршарипов, Р. Х., Ахунбаев, А. А., & Абдусаломова, Н. А. К. (2020). Оптимизация конструкции сушильного барабана на основе системного анализа процесса. Universum: технические науки, (11-1 (80)), 59-65.
3. Тожиев, Р. Д., Ахунбаев, А. А., Миршарипов, Р. Х., & Ражабова, Н. Р. (2021). Исследование гидродинамических процессов при сушке минеральных удобрений в барабанных сушилках. Научнотехнический журнал, 4(4), 15.
4. Ахунбаев, А. А. (2021). Гидродинамическая модель движения

International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 03 ISSUE 04 Pages: 66-71
SJIF IMPACT FACTOR (2021: 5.478) (2022: 5.636) (2023: 6.741)
OCLC – 1368736135
ISSN-2750-1396

в барабанном аппарате с учетом влияния продольного перемешивания. Universum: технические науки, (9-1 (90)), 34-38.

5. Гаппаров, К. (2021). Промышленное опробование технологии очистки и переплавки вторичных баббитов. Universum: технические науки, (10-1 (91)), 63-67.
6. Gapparov, K. G., Tojiboyev, B. T., & Mansurov, Yu. N. Uchrediteli: Metallurgizdat. Metallurg, 11, 101-105.
7. Гаппаров, К. Г., Эркабоев, Х. Ж., Мансуров, Ю. Н., & Аксёнов, А. А. (2021). Структурный анализ вторичных баббитов. Металлург, 5, 60-64.
8. Hamzaev, I., Gapparov, K., Umarov, E., & Abdullaev, Z. (2021). Application of the method of finite differences to the calculation of shallow shells. Universum: технические науки, (3-4), 71-76.
9. Gaparo, K. G. (2021). Research of physical and mechanical properties of babbits filled in sliding bearings. Scientific-technical journal, 4(4), 63-67.
10. Gapparov, K. G., & Mavlonova, O. (2022). Strukturniy analiz vtorichnix babbitov. Oriental renaissance: Innovative, educational, natural and social sciences, 2(3), 1223-1232.
11. A.A. Muidinov, E.V. Koraboev, Sh.U. Juraev, A.A. Akhunbayev (2022) HYDRODYNAMICS OF DISPERSED MATERIAL MOVEMENTIN THE DRYING Semdesyat pyataya vserossiyskaya nauchno-texnicheskaya konferensiya studentov, magistrantov i aspirantov mejdunarodnim uchastiyem. 1(3), 241-253
12. A.A. Muidinov, E.V. Koraboev, Sh.U.Jurayev, A.A. Akhunbayev. (2022). Gidrodinamika dvijeniya dispersnogomateriala v sushilnom barabane Semdesyat pyataya vserossiyskaya nauchno-texnicheskaya konferensiya studentov, magistrantov i aspirantov mejdunarodnim uchastiyem. 1(4), 248-252.