The Wet Method of Enriching Quartz Sand for the Production of Glass

Ergashev Mahmudjon Mamadjanovich

Fergana Polytechnic Institute, Fergana, Uzbekistan
E-mail: m.ergashev@ferpi.uz

ABSTRACT

Method of moisture enrichment of quartz sands is required in the glass industry. In recent years, a number of information about the wet process and used industrial equipment for the enrichment of quartz sands have been published. This article discussed the wet method of enriching quartz sands for glass production.

Keywords: Glass, enrichment of glass sand, Quartz, improvement of the quality of quartz sand, quality glass.

Introduction

Glass is one of the most sought-after materials in our time, due to its properties. It is used in construction, agriculture, petrochemistry, mechanical engineering, electronics, the food industry, etc.

Different industries require types of glass with certain characteristics. They largely depend on the technology and on what raw materials were used for glass production. Glass is made from natural raw materials that melt at very high temperatures. The main ingredient of glass is sand, the main component of sand is quartz, also known as silicon dioxide (SiO_2), silica or quartz sand [1-7].

The main part

Quartz sand for glass production should be as pure as possible. Iron and aluminium oxides are considered the most harmful impurities in it. Increased requirements for product quality in the glass industry and the transition to new state standards such as GOST 111-2014, increased requirements for raw materials in glass production [8-11]. To produce high-quality glass products, it is necessary to use high-quality raw materials (quartz sand is the main component of glass production).

Table 1.

Options	*Specification and indicators*
Loading material	Quartz sand
Density, t/m^3	2,65
Granulometric composition of the sand:	The average yield in % with deviation characteristics
> 1,0 мм	1,6 from 1 to 11
- 1,0 + 0,63 мм	0,5 from 0,4 to 2
- 0,63 + 0,5 мм	0,9 from 0,6 to 2
- 0,5 + 0,315 мм	16 from 16 to 20
- 0,315 + 0,250 мм	29 from 26 to 32
- 0,250 + 0,100 мм	53 from 50 to 56
< 0,100 мм	1 from 0,5 to 3
Dry solid material loading capacity	50 t/h on initial loading
Glass sand production capacity	200. 000 tons per year
Chemical analysis of the initial sand:	
SiO_2	97,5 – 99 %
Fe_2O_3	0,08 – 0,15 %

Granulometric composition of the product	0,10 – 0,63 mm
Tolerances for deviations from the specified grain composition	max. 2% < 0.10 mm
	max. 3% > 0.63 mm
Chemical composition of the product after enrichment:	
SiO_2	> 99 %
Fe_2O_3	0,02- 0,05 %

Silica sand, which is an ideal basis for glass production, is mined in an open pit.

In order to determine whether sand will become a suitable raw material, it is subjected to many chemical analyzes, during which the presence of harmful impurities is detected. After preliminary assessments by the State Institute of Glass (GIS) in Moscow, as well as the results of testing 2 samples performed in the laboratory "Gormashexport" in 2015, testing confirmed the conclusions of the GIS that as a result of the enrichment of the sands of the Navoi and Samarkand regions using methods of disintegration, mechanical activation, gravitational enrichment, classification and desliming, it is possible to obtain sands with grade BC-050 and higher.

Figure 1. Glass sand enrichment technology

The European “AKW-Apparate-Ferfaren” Gmbh (Germany) line of wet sand beneficiation with a capacity of 50 tons per hour was introduced at JSC “Quartz”.

Initial raw material. The deposit of quartz sand is located in the Navoi region and Samarkand region, near the Kyzylkum desert.

Characteristics of the sands. Data on the chemical, mineralogical and granulometric composition of sands are contained in the geological report on the quartz sand deposit. The material of the deposits of the Navoi and Samarkand regions is represented by both grains of sand and weakly cemented sandstones [12-16]. To calculate the product balances, data on the granulometric composition of previously studied samples were used. Both samples are distinguished by a high degree of contamination in large classes. Significant differences in the content of large debris in the samples studied by the Institute during sampling, and random debris was removed from the samples.

When converted to class 0-2. 0 mm, all 4 samples are very close in terms of the content of the commodity class 0. 1-0. 5 mm constituting 97.96, 96.5, 98.01 and 95.29%.

The class larger than 2 mm is represented by inclusions similar in structure to stalactites, plant roots and root remains with varying degrees of saturation with carbonates and other salts.

The origin of the inclusions seems to be associated with the formation of crystalline structures in the dead roots of desert plants, such as saxaul. Quartz fragments were not found in large inclusions.

Figure 2. Scrubbers. (they allow effective disintegration of materials with a clay content of up to 50% or more.)

Commodity class content 0. 1-0. 5 mm in original sands is 85.7-91. 3%. Taking into account the losses of sand as a result of mechanical activation and gravitational enrichment, the yield of a commercial grade is 81.41-86.7%. Taking into account the fact that the deposits are heterogeneous in their structure and composition of sand (which can be seen even with the naked eye), it is planned to clean and enrich the sand. To improve the quality of quartz sand, in 2020, the construction of an enrichment line with a capacity of 50 tons/hour was implemented at JSC "Quartz". This quartz sand processing line reduces iron oxide and improves the quality of quartz sand used in the production of flat glass and container glass.

Enrichment line operating mode. The mode of operation of the line for the enrichment of quartz sands is adopted year-round, with a continuous working week of 3 shifts of 8 hours, which is 24 working hours a day. Taking into account the cold snap in the winter months, the construction of a seasonal enrichment line stopping for 2-3 frosty months was considered, which led to the need to increase the productivity of the enrichment line to 50 tons/hour and organize a warehouse of enriched sand with a 2-3 month supply.

Conclusion

Taking into account the expected output of commercial sands at the level of 81.41%, the production capacity of the line for the initial sands should be 40 t/h.

Main products:

- Glass sand grades VS-050-1 and VS-030-1 have a chemical according to the requirements of GOST 22551-77 "Enriched quartz sand".
- The humidity of sand at the level of 4-6%
- The content of iron oxide Fe_2O_3 - 0.02-0.05%

The sand may contain inclusions of size 0.5(0.8)-2. 0 mm removed on a burat sieve in the joint shop of JSC "Quartz". Storage of wet sands is provided. Drying and packing of sands at this stage are provided. This line of wet sand enrichment allows the enterprise to obtain the purest quartz sand and, as a result, the production of high-quality glass and glass containers.

References

1. Лукина, К. И., Якушкин, В. П., & Муклакова, А. Н. (2016). Обогащение полезных ископаемых. *Международный журнал экспериментального образования*, (6-1), 94-95.
2. Кузьмина, Н. И. (2007). Критерии определения пределов обогатимости различных природных типов кварцевого сырья. *Разведка и охрана недр*, (10), 49-51.
3. Бурьян, Ю. И., Борисов, Л. А., & Красильников, П. А. (2007). Кварцевое сырье-важнейший вид минеральных ресурсов для высокотехнологичных отраслей промышленности. *Разведка и охрана недр*, (10), 9-12.
4. Степаненко, А. А. (2016). Механоактивация. Возможности и перспективы. In *Цветные металлы и минералы-2016* (pp. 392-393).
5. Конгресса, В. М. (2016). Цветные металлы и минералы. С. 392-393
6. Степаненко, А. И. (2015). Оборудование и технологии для обогащения некондиционного сырья. *X Конгресс обогатителей стран СНГ: Сборник материалов*, *2*, 610.
7. Эргашев, М. М. (2020). Утилизация строительных отходов-мировой опыт. *Теория и практика современной науки*, (10), 90-93.
8. Эргашев, М. М., Мамажонов, А. У., Умирзаков, З. А., & Насирдинов, Х. Ш. (2019). Влияние наполнителя и добавки АЦФ-3М на реологические свойства цементного теста. *Проблемы современной науки и образования*, (12-2 (145)), 39-46.
9. Эргашев, М. М. (2020). Применение нанотехнологий в производстве цемента. *Экономика и социум*, (1), 952-955.
10. Kuziboevich, M. B., & Nabijonovich, A. N. (2021). Results Of Studying The Physical And Mechanical Properties Of Polystyrene Concrete With Additional Complex Chemical Additive Kdj-3 Based On Local Raw Materials. *The American Journal of Engineering and Technology*, *3*(06), 30-34.
11. Эргашев, М. М. (2020). Строительная индустрия узбекистана: перспективы развития. *Экономика и социум*, (1), 947-951.
12. Yunusov, M. P., Teshabaev, Z. A., Mirzaeva, E. I., Nasullaev, K. A., Ergashev, M. M., Ruzimuradov, O. N., & Murzin, D. Y. (2022). Effect of protective bed composition on deactivation of a hydrotreating catalyst. *Journal of Chemical Technology & Biotechnology*, *97*(3), 771-778.
13. Mamadjanovich, E. M. (2021). Technology preparation of oils for modern engines on the basis of raw material and high sulfur content. *Innovative Technologica: Methodical Research Journal*, *2*(11), 127-132.
14. Эргашев, М. М. (2021). Применение строительной керамики в современной индустрии и жилищном строительстве. *Экономика и социум*, (6-2), 608-611.
15. Yunusov, M. P., Molodozhenyuk, T. B., Ergashev, M. M., Dzhalalova, S. B., Gashenko, G. A., & Saidulaev, B. M. (2007). Investigation of a system of protecting layer for the process of hydrorefining oily distillates of Uzbekistan's petroleum. *Russian Journal of Applied Chemistry*, *80*(7), 1207-1212.
16. Эргашев, М. М., Мамажонов, А. У., Умирзаков, З. А., & Насирдинов, Х. Ш. (2019). Влияние наполнителя и добавки АЦФ-3М на реологические свойства цементного теста. *Проблемы современной науки и образования*, (12-2 (145)), 39-46.