

PROCESS FOR PURIFYING SILICA SAND

226958X

This invention refers to a process for purifying silica sand and, more particularly, to a process for the elimination of iron, aluminosilicates and other impurities from silica sand particles.

Sand particles are normally contaminated with binder-type clay, iron, aluminosilicates and other impurities which have to be removed for particular uses in the glass, ceramic and other product manufacturing.

One of the most difficult impurities to release from the sand particles is the iron compound normally staining said particles.

There are some methods for the elimination of iron stains from the sand particles, mainly by mechanical attrition and by transforming the iron impurities into soluble iron salts by treatment with a chemical agent such as concentrated sulfuric acid or some alkalies.

U.S. patents No. 4'405,588 and 4'401,638 (corresponding to mexican patents 159,830 and 159,831) of Caballero et al, each respectively disclose a process for removing impurities from silica sand particles, involving several steps of attrition and a chemical attack or lixiviation step which requires a relatively great amount of water and chemical reagents such as concentrated sulfuric acid, to remove said iron stains from said sand particles.

Said attrition steps combined with said chemical attack, were absolutely necessary in said processes because of the characteristics of the attrition which were not and cannot be vigorous enough in the existing methods as to remove the persistent iron stains.

Additionally, together with the sand there are also independent hard particles of aluminosilicates which, in the previous processes, were only polished and diminished in size by said attrition steps to be subsequently eliminated by additional flotation or screening steps.

It was therefore highly desirable to simplify the process by reducing at the minimum the number of attrition steps and also by suppressing the chemical attack or at least to reduce at the minimum the consumption of water and chemical reagents of said step.

Such simplification in the process for purifying silica sand is now possible in accordance with the present invention, by providing a new abrasive-attrition step in which the sand particles are so vigorously attritioned that wears the particle surface thus removing the iron stains therefrom. Iron particles may afterwards be eliminated from the sand particles for example by magnetic separation, flotation, hydroclassification or screening but preferably by high intensity magnetic separation.

Furthermore, the characteristics of said new abrasive-attrition step are so peculiar as to cause that said sand particles be so vigorously attritioned to each other that pulverize independent aluminosilicate and other softer contaminant particles which are finally eliminated simply by washing and/or screening.

The process for purifying silica sand, in accordance with the present invention, simplifies in this way the process by reducing, to one, the number of the conventional attrition steps and suppresses the necessity of the chemical attack, or at least allows to carry out said chemical attack in most soft conditions

(simply in the presence of acid humidity), considerably reducing the consumption of water (at about 30%) and chemical reagents when high degree of purity is required for the sand.

It is therefore an object of the present invention, to provide a process for purifying silica sand

to eliminate or reduce impurities such as iron, aluminosilicates and other impurities contaminating it.

It is another object of the present invention, to provide a simplified process for purifying silica sand

by providing an abrasive-attrition step which is so vigorous that wears the surface of the sand particles thus removing the iron staining them which may afterwards be easily eliminated from said sand particles.

It is also an object of the present invention, to provide a simplified process for purifying silica sand

of the above disclosed nature, wherein the abrasive-attrition step is so peculiar as to cause that said sand particles be so vigorously attritioned to each other that pulverize independent aluminosilicate and other contaminant particles which are finally eliminated simply by washing and/or screening.

It is still an object of the present invention, to provide a simplified process for purifying silica sand

of the above disclosed nature, which simplifies the process by reducing, to one, the number of the conventional attrition steps of the conventional processes

It is a further object of the present invention, to provide a simplified process for purifying silica sand

of the above disclosed nature, which allows to

suppress the necessity of the chemical attack, or at least allows to carry it out under most soft conditions considerably reducing the consumption of water and chemical reagents when high degree of purity is required for the sand.

These and other objects and advantages of the present will be evident to the persons skilled in the art, from the teachings of the present invention described in the following detailed, non-limitative description of the invention, provided in combination with the accompanying drawings.

Figure 1 is a flow sheet of the process for purifying silica sand or other materials, of the present invention.

Figure 2 is a schematic view of the apparatus for abrasive-attrition, to be used in the process of the present invention.

In the following, the invention will be described in combination with the accompanying drawings wherein the same reference numbers refer to the same parts of the shown figures.

Referring to Figure 1, the process for purifying silica sand of the present invention comprises:

feeding sandstone 1 by means of conveyor 2 into a grinder or crusher 3, to uniformly reduce the size of sand particles;

transferring said ground and classified sand particles by a conveyor 4, to a washing tank 5 wherein said sand particles are washed with cold water forming an aqueous suspension of clay-binder material which is extracted through line 6, whereas the heavier sand particles having still adhered some clay-binder is passed through line 7 to an attrition scrubber 8 to deslime and release additional clay-binder;

feeding said sand particles to a deslimmer 9 to finally remove the binder from said sand particles which are passed to a deposit 10;

transporting, by means of conveyor 11, said deslimed sand particles from the deposit 10 to an abrasive-attritioner 12 comprising an inclined rotary recipient 13 having a rotary shaft 14 placed eccentrically within recipient 13, including a plurality of rotary blades 15 at different levels thereof and a vertical deflector 16 placed in contact with the inner wall of the rotary recipient 13, to subject the sand particles to an abrasive action caused by the downstream and upstream movements of the sand particles in said inclined rotary recipient 13 and by the abrasive friction of the sand particles against said revolving blades 15, wearing the surface of the sand particles removing the iron stains and crushing and pulverizing in this way the aluminosilicate particles;

finally passing said sand particles from said abrasive-attritioner 12 to a washer tank 17 wherein it is washed with cold water to remove the aluminosilicates which remain as a suspension which is extracted through line 18, while the sand particles and ferrous particles separated therefrom are passed to a magnetic separator 19 comprising conveyor 20 having magnetic rollers 21 which adheres the ferrous particles which are afterwards released in deposit 22, whereas the sand particles free of impurities goes down by gravity immediately after the separating conveyor 20, in a deposit 23.

Suitably the above-mentioned abrasive-attrition step is carried out in the presence of humidity, or in the presence of acidified or alkalinized water.

E X A M P L E S .

Batches of about 8 Kg. of ground and classified silica sand were treated in an intensive countercurrent mixer, normally used for mixing purposes and which was modified and adapted to be utilized in this process, using a tangential velocity of 31.2 m/seg. In this equipment two samples of sand from "Lampazos" and two samples of "Jaltipan" were processed in dry conditions with 100% of solids, varying the times of abrasive-attrition from 2.5 to 10 minutes.

The starting temperature of the sand was of 10°C and was gradually increased at 42°C at the first 2.5 min.; at 56°C at the 5 min.; at 67°C at the 7.5 min.; and finally at 75°C at the 10 min.

The results obtained in the four tests are shown in the next table, wherein the batch of sand particles with an initial content of impurities is designed as HEAD and afterwards are shown the results after the abrasive-attrition and magnetic separation in accordance with the present invention.

SAND OF "LAMPAZOS":

T E S T 1 .

	Fe_2O_3	Al_2O_3
HEAD	0.087	0.745
ABRASIVE-ATTRITION + WASHING (# 120)	0.047	0.450
AFTER MAGNETIC SEPARATION	0.031	0.440

T E S T 2 .

	Fe_2O_3	Al_2O_3
HEAD	0.077	0.730
ABRASIVE-ATTRITION + WASHING (# 120)	0.043	0.730
AFTER MAGNETIC SEPARATION	0.032	0.460

SAND OF "JALTIPAN":

T E S T 3 .

	Fe_2O_3	Al_2O_3
HEAD	0.200	0.375
ABRASIVE-ATTRITION + WASHING (# 140)	0.125	0.150
AFTER MAGNETIC SEPARATION	0.024	0.150

T E S T 4 .

	Fe_2O_3	Al_2O_3
HEAD	0.200	0.375
ABRASIVE-ATTRITION + WASHING (# 140)	0.150	0.180
AFTER MAGNETIC SEPARATION	0.022	0.170

As it is evident from the above test results, after abrasive-attrition and washing, the contents of Al_2O_3 is reduced to approximately to one half. This is due mainly to the feldspar particles which were ground by the sand particles reduced to a powder, while in the magnetic separation practically did not reduced its content.

Regarding to the impurities of Fe_2O_3 , these were also practically reduced to the half after abrasive-attrition and washing at 120 and 140 meshes, corresponding to the ferrous fine particles removed from the surface of the sand particles.

In the sand of "Lampazos", after magnetic separation, the contents of Fe_2O_3 were reduced additionally in a 25%, while in the sand of "Jaltipan" were reduced at 80% corresponding so much to the free ferrous minerals as to the iron particles originated by the wear of the equipment.

CLAIMS



1. A process for purifying silica sand, consisting of:

5 a) abrasive-attritioning a sand particle mixture by
subjecting the sand particles to centrifugal rotation
under dry conditions, while simultaneously agitating the
particles with translative eccentric, downstream, and
upstream movements, wherein the surface impurities are
removed from the sand particles, and

10 b) eliminating the impurities from the sand particle
mixture.

2. A process for purifying silica sand as claimed in
claim 1, wherein the abrasive-attrition step wears the
15 surfaces of sand particles to remove iron stains.

3. A process for purifying silica sand as claimed in
claim 1 or claim 2, wherein the abrasive-attrition step
is carried out in the presence of humidity.

20 4. A process for purifying silica sand as claimed in
claim 1 or claim 2 wherein the abrasive-attrition step is
carried out in the presence of acidified or alkalinized
water.

25 5. A process for purifying silica sand as claimed in
any one of the preceding claims further comprising
washing said abrasive-attritioned sand particles to
remove the iron, aluminosilicate and other impurities.

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6. A process for purifying silica sand as claimed in any one of the preceding claims wherein elimination of iron impurities from said abrasive-attritioned sand particles is carried out by magnetic separation.

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7. A process for purifying silica sand as claimed in any one of claims 1 to 5 wherein elimination of iron impurities from said abrasive-attritioned sand particles is carried out by flotation.

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8. A process for purifying silica sand as claimed in any one of claims 1 to 5 wherein elimination of iron impurities from said abrasive-attritioned sand particles is carried out by hydroclassification.

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9. A process for purifying silica sand as claimed in any one of claims 1 to 5 wherein elimination of iron impurities from said abrasive-attritioned sand particles is carried out by screening.

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10. A process for purifying silica sand substantially as herein before described with reference to the Examples.

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