(54) Title: PROCESS FOR PRODUCING ALUMINUM HYDROXIDE BY SEEDED PRECIPITATION OF SUPERSATURATED SODIUM ALUMINATE SOLUTION

(57) Abstract:
Disclosed is a process for producing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, comprising carrying out local agitation only at the bottom of a seeded precipitation tank, of which the intensity is sufficient to maintain the aluminum hydroxide particles at the bottom of the seeded precipitation tank in a suspended state, to promote diffusion mass transfer of the sodium aluminate solution with a high solid content and a high molecular ratio at the bottom of the seeded precipitation tank, and to prevent the aluminum hydroxide particles from deposition at the bottom of the seeded precipitation tank.
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ABSTRACT

Disclosed is a process for producing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, comprising carrying out local agitation only at the bottom of a seeded precipitation tank, of which the intensity is sufficient to maintain the aluminum hydroxide particles at the bottom of the seeded precipitation tank in a suspended state, to promote diffusion mass transfer of the sodium aluminate solution with a high solid content and a high molecular ratio at the bottom of the seeded precipitation tank, and to prevent the aluminum hydroxide particles from deposition at the bottom of the seeded precipitation tank.
PROCESS FOR PRODUCING ALUMINUM HYDROXIDE BY SEEDED PRECIPITATION OF SUPERSATURATED SODIUM ALUMINATE SOLUTION

TECHNICAL FIELD

The present invention relates to a process for producing alumina, in particular, a process for preparing aluminum hydroxide by seeded precipitation of supersaturated sodium aluminate solution. The present invention belongs to the field of metallurgy.

BACKGROUND

The Bayer process for producing alumina has advantages such as simple procedures, easy operation and high product quality. Currently, more than 90% of alumina is produced by the Bayer process worldwide. During the production of alumina by the Bayer process, one of important procedures is a precipitation reaction by adding seed crystals into the supersaturated sodium aluminate solution, which is usually referred to as “seed crystal precipitation procedure” or abbreviated as “seeded precipitation procedure”. This procedure involves adding a large amount of aluminum hydroxide, as seed crystals, into the supersaturated sodium aluminate solution, conducting induced crystallization and growth of aluminum hydroxide crystals, decomposing the supersaturated sodium aluminate solution for 35-75 hours to obtain a slurry of aluminum hydroxide, conducting liquid-solid separation of the slurry and grading the resultant particles according to particle size, washing and dehydrating aluminum hydroxide coarse particles obtained by precipitation to obtain alumina product; returning fine particles of aluminum hydroxide to the precipitation procedure for use as seed crystals. Therefore, the seeded precipitation is one of the key procedures to control technical-economical index of alumina product. The device used in the seeded precipitation procedure of the supersaturated sodium aluminate solution is called as “seed crystal precipitation tank” or abbreviated as “seeded precipitation tank or precipitation tank”. The production process is usually carried out with several
to more than ten of tandem precipitation tanks.

For a long time, the seeded precipitation procedure of sodium aluminate solution always employs entirely stirring the slurry in each seeded precipitation tank, *i.e.* a precipitation process of complete mixing flow. At present, there are two widely used processes, *i.e.* an air-agitated complete mixing flow precipitation and a mechanical agitation complete mixing flow precipitation. The seeded precipitation tank used air-agitated complete mixing flow precipitation has simple structure, low production cost and less maintenance cost. However, such process still has some disadvantages. a) High power consumption. Since the seeded precipitation tank generally has a height of about 30 meters and the slurry has a quite high static pressure, a compressed air with higher power consumption is required to meet the complete mixing flow. b) The seeded precipitation tank is prone to lumping (or scaling) on the wall, especially producing big lumps at the top of the tank, so that the discharge tube would be easily blocked due to the detachment of the lumps, leading to serious production accidents of a precipitation tank. c) It is easy to result in “short-circuit” and “back-mixing” phenomena in the precipitation slurry, so as to lower the precipitation driving force of the slurry with low molecule ratio which just enters the seeded precipitation tank. d) While agitating with air, the slurry absorbs CO₂ in the air to convert a part of caustic alkali into carbonated alkali, which does not have benefits for seeded precipitation. The mechanical agitation complete mixing flow precipitation process involves continuous agitation with a mechanical agitation device having specially designed multilayer blades erected in the seeded precipitation tank. Although such intense agitation can prevent the accumulation and deposition of crystals at the bottom of the precipitation tank, the shear force produced in the flow field of sodium aluminate solution will hinder the crystallization and growth process of aluminum hydroxide. Therefore, aluminum hydroxide particles that have been crystallized and grown are broken, abraded and refined such that the quality of the product is lowered, which does not have benefits for production of sandy alumina product. Furthermore, since the precipitation tank is bulky and the mechanical agitation device has a length of tens of meters and a large mixing load, not only the
components, such as agitation shaft, agitation blades and the like, of the agitation system are required to be more precisely manufactured, but the power consumption is larger, the cost for manufacture and installation is expensive and maintenance cost is high. A seeded precipitation tank having a diameter of 14 meters and a height of 35 meters shall be equipped with a 75kW agitation motor and a gearbox, leading to a high cost. Moreover, the motor shall continuously run without shut-down and shut-off, thus a lot of energy is consumed. It is proved from years of production practice that both air-agitated complete mixing flow and mechanical agitation complete mixing flow can cause blending between upper layer of liquid and lower layer of liquid (commonly known as “short-circuit”), thereby decreasing the supersaturation degree of sodium aluminate solution transported into the seeded precipitation tank and reducing the reaction efficiency. In the meantime, the intense agitation complete mixing flow also causes the reduction in particle size of the product. The invention of “Method and Apparatus for Decomposing Sodium Aluminate Liquors without Agitation to Produce Alumina” by PECHINEY ALUMINIUM, France, in 1985, (CN85108251A or US4666687), discloses a process involving complete cancellation of agitation to achieve energy saving and reduce lumping phenomenon. However, this invention is only applicable to a small amount of seeded precipitation tank (about 1500 m³) with a cylinder-cone shape, and cannot be used in a large seeded precipitation tank with a flat bottom, an arc bottom or others. Moreover, the solid content of sodium aluminate solution is restricted to 600-700g/L or less and the flow rate of slurry is particularly limited. Therefore, this invention is applicable to a limited scope and thus cannot meet requirements of the current seeded precipitation technology development for a large-capacity (4000 m³ or more), high solid content (800-1000 g/L) precipitation equipment. Moreover, because this invention completely cancels agitation, a large number of solid contents easily accumulated and deposited at the bottom of seeded precipitation tank would lead to accidents of the precipitation tank such that the production process is ceased.

DISCLOSURE OF INVENTION
The technical issue to be solved in the present invention is to provide a process for producing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, with good energy saving effect, high precipitation yield, and a good product quality, thereby overcoming the above disadvantages in the prior art.

In order to solve the above technical issue, the present invention relates to such a technical solution that a process for preparing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution. The process comprises carrying out local agitation only at the bottom of a seeded precipitation tank, of which the intensity is sufficient to maintain aluminum hydroxide particles at the bottom of the seeded precipitation tank in a suspended state, to promote diffusion mass transfer of sodium aluminate solution with a high solid content and a high molecular ratio at the bottom of the seeded precipitation tank and to prevent aluminum hydroxide particles from deposition at the bottom of the seeded precipitation tank.

According to the above mentioned process for producing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, the local agitation at the bottom of the seeded precipitation tank may be a local agitation with compressed air at the bottom of seeded precipitation tank or a local agitation with a mechanical device at the bottom of seeded precipitation. However, the agitation is not limited to air agitation, mechanical agitation, or the like. The purpose of agitation is to suspend the precipitated aluminum hydroxide solid particles, and to enhance the diffusion mass transfer of the slurry with a high molecular ratio and to prevent the slurry from deposition in the later stage of the reaction.

According to the previously mentioned process for preparing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, the shape of the bottom of the seeded precipitation tank may be a flat shape, a cone shape, an arc shape, a combination of various shapes, or other abnormal shapes. The purpose of the shape of the bottom is to collect and gather the solids at the bottom of the seeded precipitation tanks with different volumes and geometries, to agitate the gathered solids and to output them after mass transfer.
According to the previously mentioned process for preparing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, the local agitation at the bottom of the seeded precipitation tank is specifically a local agitation with compressed air at the bottom of the seeded precipitation tank, i.e. an agitation by blowing compressed air into the bottom of the seeded precipitation tank.

According to the previously mentioned process for preparing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, the local agitation at the bottom of the seeded precipitation tank is specifically a local agitation with a mechanical device at the bottom of the seeded precipitation tank, i.e. an agitation by using rotating blades at the bottom of the seeded precipitation tank.

According to the previously mentioned process for preparing aluminum hydroxide by a seeded precipitation of supersaturated sodium aluminate solution, the local agitation with a mechanical device at the bottom of the seeded precipitation tank is specifically a local agitation by using a layer of rotating blades at the bottom of each seeded precipitation tank, wherein the agitation intensity is sufficient to maintain the aluminum hydroxide particles at the bottom of the seeded precipitation tank in a suspended state without deposition at the bottom of seeded precipitation tank.

The technical principle of the present invention: the present invention employs a process based on course features, comprising researching the chemical reaction kinetics of seeded precipitation of sodium aluminate solution through experiments, testing and calculating the apparent activation energy for growing aluminum hydroxide crystals, and analyzing the effects of agitation mass transfer action on the reaction course. The apparent activation energy for growing aluminum hydroxide as tested is 60,920 kJ/mol. It is shown by the experimental results that the reaction of growth of aluminum hydroxide crystals has higher activation energy. Such results indicate that the crystallization reaction is dominated by surface reaction control. Therefore, a process for diffusion (e.g. enhancing the agitation intensity and the like) has no obvious promotion effects of the crystallization reaction of aluminum hydroxide crystals. On the contrary, the enhancement of the agitation intensity can only result in crushing and abrasion of grown crystal grains, thereby affecting the
product quality and wasting power. In general, where the solution lacks sufficient precipitation driving force, e.g. the solution has a higher molecular ratio, the use of certain agitation with appropriate intensity will contribute to the diffusion mass transfer of aluminate anions. However, where the solution has a lower molecular ratio and a higher precipitation driving force, the agitation can be reduced or canceled. Therefore, during the reaction, reasonable configuration of agitation position and mode is of great help to improve the yield and quality of product and to reduce power consumption and production cost, thereby increasing economic efficiency and product competitiveness of enterprises for alumina. In particular, it is possible to cancel or reduce agitation in the growth stage of aluminum hydroxide crystals in the seeded precipitation process.

According to the study on seeded reaction kinetics of sodium aluminate solution and the flow characteristics of slurry, the present invention provides such a technical route that the seeded precipitation process employs a local agitation plug flow precipitation procedure without any complete mixing flow agitation of slurry, thereby achieving energy saving. In general, it is believed that agitation can maintain aluminum hydroxide particles suspended in sodium aluminate solution, ensure the good contact of seed crystals with the solution, make the solution uniform, accelerate the precipitation of the solution, and make the aluminum hydroxide grow uniformly.

According to the measurement of the apparent activation energy in seeded precipitation of sodium aluminate solution, it is discovered in the present invention that the seeded precipitation reaction process of industrial sodium aluminate solution is dominated by surface chemical reaction control and the enhancement of agitation intensity has little effects on the efficiency of seeded precipitation. That is, the efficiency of precipitation does not depend on the diffusion process. Therefore, as to the conventional seeded precipitation process comprising air-agitated complete mixing flow, mechanical agitation complete mixing flow or draft tube agitation complete mixing flow or the like, the energy saving can be achieved by changing the entire agitation complete mixing flow precipitation to local agitation plug flow precipitation.
A major innovation of the present invention is to break through the conventional technical route that needs complete mixing flow agitation during seeded precipitation. The present invention provides a novel process of "local agitation plus plug flow". That is, the entire complete mixing flow agitation mode is changed to the local agitation mode (at the bottom of seeded precipitation tank) so that the seeded precipitation is changed from the entire complete mixing flow mode to the approximate "plug flow" mode. Where no complete mixing agitation mode (not limited to air agitation and mechanical agitation) is used, the present invention thoroughly solves the problems about solid content accumulation and deposition by applying a local agitation mode at the bottom of each seeded precipitation tank and achieves normal transport of slurry by designing a reasonable spatial structure, a high-efficient aggregate system and a matched slurry-lifting velocity, thereby achieving tandem reaction process of entire seeded precipitation system. The present invention can reduce equipment investment, achieve energy saving, effectively extend the cycle of cleaning tank, and decrease maintenance cost, while partly improving the yield of seeded precipitation and product quality of Bayer process.

The local agitation plug flow seeded precipitation tank according to the present invention is a normal pressure liquid flow operation, in which the liquid flow is slow and stable. Such liquid flow does not cause agitation and therefore a stable dynamic balance can be established in the seeded precipitation tank, so that the entire seeded precipitation process is carried out continuously and stably. The two-phase flow of seeded precipitation is regarded as a stable process. In this state, the slurry has constant weight ratio in each horizontal section vertical to the axial direction, in which the weight ratio gradually increases from top to bottom along the axial direction. The kinetic conditions of crystallization reaction are completely different from those of the conventional technical process for crystallization and precipitation by entire complete mixing agitation. Therefore, the reaction state is closer to the theoretic kinetics of batch reaction.

The beneficial effects of the present invention: as compared with the prior art, the present invention possesses the following features. (1) The present
invention does not use a conventional entire agitation complete mixing mode, but only uses local agitation at the bottom of the seeded precipitation tank so that the solution in the same cross-section perpendicular to flow direction has substantially identical properties while the solid content and supersaturation degree of the solution exhibit gradient distribution along the flow direction. The solid-liquid suspended slurry in the reaction process is similar to "plug flow", thereby not only completely avoiding back-mixing phenomenon, but completely changing the kinetic conditions of crystallization reaction of sodium aluminate solution, which are of help to improve the efficiency of seeded precipitation reaction. (2) The present invention uses local agitation mode at the bottom of the seeded precipitation tank, which can effectively avoid accumulation and deposition of solid content to ensure the normal flow, transport and production of slurry, thereby achieving the tandem reaction process of several precipitation tanks in the seeded precipitation system. In the meantime, the solution having lower supersaturation degree which enters later reaction stage at the bottom of the seeded precipitation tank (the molecular ratio $\alpha_k$ thereof is higher) needs moderate agitation, so as to contribute to the diffusion mass transfer of the precipitation reaction process and enhancement of the precipitation rate. (3) Since the present invention does not comprise intense complete mixing flow agitation action, there is no shear force caused by intense agitation in the flow field of sodium aluminate solution in the seeded precipitation tank. The solution crystallization reaction can be stably and continuously carried out in a manner of approximate "plug flow" without any agitation, so as to provide the growth and agglomeration of crystals with good reaction conditions. Therefore, the process of the growth of aluminum hydroxide crystals would not be destroyed, so as to reduce the crushing and abrasion phenomena of product particles. Consequently, an alumina product with larger particle size would be easily obtained. (4) The present invention can achieve continuous stable crystallization reaction without intense agitation and roll of the solution. Therefore, the present invention significantly saves energy, the costs of manufacture and installation of reaction appuratuses, reduces the equipment investment and operation cost, and improves the particle size contribution of the
product, while further eliminates the drawbacks of lumping due to intense roll of the liquid at the top of precipitation reaction tank, thereby extends the cleaning cycle. That is, the advantages of present invention are very prominent. Large flat-bottomed seeded precipitation tank with mechanical agitation for sodium aluminate has become the main technical process at home and abroad, in which the motor and agitation blades need high cost and routine maintenance. The use of the present invention will save equipment investment of about tens of millions Yuan for an alumina manufacture enterprise having a designed capacity of 800,000 tons per year.

The prominent feature of the present invention resides in energy saving. The technology can significantly reduce energy consumption without affecting the quality and yield of products. Comparing with the existing ejected air complete mixing flow agitation precipitation technology, the present invention can reduce the consumption of compressed air by 80-90%. Comparing with the existing mechanical complete mixing flow agitation precipitation technology, the present invention saves 30-40% of direct power consumption. Therefore, the present invention has good technical and economic indexes.

The main technical features of the present invention reside in that: as compared with prior art, the present invention can meet the technical conditions required for the tandem production of sodium aluminate solution having a solid content of 1,000 g/L or less in N seeded precipitation tanks. According to the present invention, while sodium aluminate solution flows in a pattern of “plug flow” in the seeded precipitation tank, the solution in each infinitesimal volume moves forward at the same speed. Therefore, no back-mixing is present in the flow direction of the solution and the composition of the solution in each section along radial direction of the seeded precipitation tank changes little over time. Therefore, $\alpha_s$ will not be disturbed and the precipitation crystallization reaction is carried out continuously and stably. The aluminum hydroxide crystal particles flow with the solution through an aggregate plate to uniformly disperse in a small area at the bottom, and then are elevated by agitation so as to output through a lifting pipe. After aggregating, the solid particles are concentrated within a small scope of the bottom and can be
effectively output, so that the materials are not easily accumulated at the bottom. In the meantime, such local agitation can contribute to mass transfer of sodium aluminate solution having high molecular ratio in the local region without affecting the approximate plug flow state of the sodium aluminate solution having low molecular ratio at the top of the seeded precipitation tank and the kinetic conditions for crystallization reaction. Furthermore, the precipitation rate of sodium aluminate and product quality can be improved. On the one hand, the reaction is carried out in the seeded precipitation tank which is equivalent to piston-pressurized liquid flow conditions, and the reaction driving force thereof is better than the conditions where a uniform state is achieved by sufficient agitation. On the other hand, the flow field in the seeded precipitation tank only has low shear force to enhance the aggregate of aluminum hydroxide crystals of small size, thereby contributing to a particle size contribution of least small particles.

In order to demonstrate the technical effects of the present invention, the applicant carried out the following industrial tests: in a 400,000 tons per year seeded precipitation production line of a domestic alumina plant, a complete production line, as the experiment group, contained tandem 14 seeded precipitation tanks with conical bottom Φ 8.2 m × 29.7 m manufactured according to the present invention, while two parallel production lines using complete mixing agitation technology were used as comparative groups.

Statistical results:
(1) Compressed air consumption.

The compressed air consumption was identified by the Provincial Energy-Saving Monitoring Center: the average compressed air consumption of the experimental group is 14.82 m³/h, while the average compressed air consumption of the comparative groups is 205.3 m³/h. Therefore, the experimental group can save air volume of 190.48 m³/h and the energy saving rate is of 92.78%.

(2) Changes of αk and precipitation rate

Table 1 shows a statistical analysis of the difference of precipitation rate among groups. The results indicate that the average precipitation rate of the
experimental group is 1.55 percent higher than the average values of the other two parallel comparative groups.

Table 1. Comparison of precipitation rates between the present invention and the complete mixing agitation technology

<table>
<thead>
<tr>
<th></th>
<th>Precipitation rate/%</th>
<th>Absolute enhancement of precipitation rate/%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental group</td>
<td>Comparative group 1</td>
</tr>
<tr>
<td></td>
<td>51.71</td>
<td>50.57</td>
</tr>
<tr>
<td></td>
<td>52.06</td>
<td>49.84</td>
</tr>
<tr>
<td></td>
<td>51.85</td>
<td>50.27</td>
</tr>
</tbody>
</table>

Under the identical conditions, the experimental group according to the present invention has slightly higher precipitation rate than the comparative groups (group 1 and group 2) using conventional entire agitation complete mixing flow. The major factors that cause the increase of precipitation rate are as follows.

a) The local agitation plug flow precipitation of the present invention does not disorder the distribution of $a_{c}$ of the slurry in the seeded precipitation tank, i.e. orderly arrangement from top to bottom. In the meantime, the liquid flows slowly and stably without causing intense agitation. Therefore, a stable dynamic balance is established in the seeded precipitation tank, thereby continuously and stably carrying out the whole seeded precipitation process.

b) The plug flow seeded precipitation tank of the present invention ensures the effective reaction route or time of the slurry. Since the plug flow precipitation completely avoids "short-circuit" and "back-mixing" of the slurry, the slurry in the seeded precipitation tank can realize the full reaction.

c) The plug flow precipitation mode of the present invention increases the effective reaction volume in the tank. The entire slurry in the plug flow seeded precipitation tank flows towards the same direction without dead zone in the tank,
thereby effectively using the whole volume. However, in the conventional ejected compressed air complete mixing agitation seeded precipitation tank, the volume of air that produces emulsified slurry occupies some volume in the tank.

(3) Particle size distribution of aluminum hydroxide

In terms of particle size distribution, local agitation plug flow seeded precipitation tank according to the present invention (the experimental group) has similar crystalline grain morphology and reduced distribution of fine-grained grains in each stage, comparing with the conventional rejected compressed air complete mixing agitation seeded precipitation tank (comparative group 1 and comparative group 2).

The above experimental results show that according to the present invention the precipitation rate of supersaturated sodium aluminate solution has been increased slightly and the particle size quality has been improved. The product particles of aluminum hydroxide have regular crystal structure, regular shape and less adhesion of crushed fines on the crystal surface. However, prolonged hexagon crystals produced by the conventional ejected compressed air entire agitation complete mixing process have damaged corner angle and broken edge while a large number of crushed fine particles adhered on the crystal surface. These crushed fine particles are produced partly by breaking crystals due to larger shear force present in the complete mixing flow filed, and partly possibly by the growth and adhesion of secondary crystal nucleus thereon.

The present invention is further illustrated below in conjunction with specific embodiments.

SPECIFIC EMBODIMENTS

Example 1

Mechanical agitation seeded precipitation tanks having cylinder-flat bottomed structure were used, in which each seeded precipitation tank had a diameter of 14 m, a height of 35 m and a tank volume of 4500 m$^3$. Only one layer of rotating blades was used at the bottom (or discharge end) of each seeded precipitation tank for
local agitation with an intensity sufficient to maintain the aluminum hydroxide particles at the bottom of the seeded precipitation tank in suspended state without deposition at the bottom of the seeded precipitation tank. Other conditions were followed according to the operation procedures for daily production in an alumina plant. The slurry-lifting velocity at the discharge end of the seeded precipitation tank was greater than interference settling final velocity of solid particles in the solution. The slurry-lifting may be realized by, but not limited to, compressed air, mechanical pump, a process of producing liquid level difference, or the like. Comparing with the initial complete mixing agitation process, in which multilayer of blades (generally five layers) were set along the agitation axis, this example only sets one layer of blades near the bottom of the seeded precipitation tank. Therefore, this example not only decreased the load of motor and power consumption, but reduced the manufacturing difficulty of components such as rotating shafts, bearings and the like.

Example 2

Air agitation seeded precipitation tanks having cylinder-conical bottomed structure were used, in which each seeded precipitation tank had a diameter of 8.2 m, a height of 29.7 m and a tank volume of 1300 m³. Compressed air was blowing into the bottom (or discharge end) of each seeded precipitation tank for local agitation with an intensity sufficient to maintain the aluminum hydroxide particles at the bottom of the seeded precipitation tank in suspended state without deposition at the bottom of the seeded precipitation tank. Other conditions were followed according to the operation procedures for daily production in an alumina plant. The slurry-lifting velocity at the discharge end of the seeded precipitation tank was greater than interference settling final velocity of solid particles in the solution. The slurry-lifting may be realized by, but not limited to, compressed air, mechanical pump, a process of producing liquid level difference, or the like.

Example 3

Air agitation seeded precipitation tanks having cylinder-multicone
bottom combination were used, in which each seeded precipitation tank had a diameter of 15 m, a height of 35 m and a tank volume of 5500 m³. Compressed air was blowing into each cone base (or discharge end) of the bottom of each seeded precipitation tank for local agitation with an intensity sufficient to maintain the aluminum hydroxide particles at the bottom of the seeded precipitation tank in suspended state without deposition at the bottom of the seeded precipitation tank. Other conditions were followed according to the operation procedures for daily production in an alumina plant. The slurry-lifting velocity at the discharge end of the seeded precipitation tank was greater than interference settling final velocity of solid particles in the solution. The slurry-lifting may be realized by, but not limited to, compressed air, mechanical pump, a process of producing liquid level difference, or the like.

The scope of the claims should not be limited by the preferred embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.
THE EMBODIMENTS OF THE INVENTION FOR WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A process for producing aluminum hydroxide by seeded precipitation of a supersaturated sodium aluminate solution, the process comprising:
   carrying out a local agitation only at a bottom of a seeded precipitation tank, wherein an intensity of the local agitation is sufficient to maintain aluminum hydroxide particles at the bottom of the seeded precipitation tank in a suspended state, to promote diffusion mass transfer of the sodium aluminate solution at the bottom of the seeded precipitation tank and to prevent the aluminum hydroxide particles from deposition at the bottom of the seeded precipitation tank;
   wherein the sodium aluminate solution flows in a pattern of “plug flow” in the seeded precipitation tank, while a precipitation crystallization reaction is carried out continuously and stably; and
   wherein the aluminum hydroxide crystal particles flow with the solution through an aggregate plate to uniformly disperse in a small area at the bottom, and then are elevated by agitation so as to output through a lifting pipe.

2. The process of claim 1, wherein the local agitation at the bottom of the seeded precipitation tank is a local agitation with air at the bottom of the seeded precipitation tank.

3. The process of claim 1, wherein the local agitation at the bottom of the seeded precipitation tank is a local agitation with a mechanical device at the bottom of the seeded precipitation tank.

4. The process of any one of claims 1 to 3, wherein the shape of the bottom of the seeded precipitation tank is a flat shape, a cone shape, an arc shape, or a combination thereof.

5. The process of claim 2, wherein the local agitation at the bottom of the seeded precipitation tank is an agitation by blowing compressed air into the bottom of the seeded precipitation tank.

6. The process of claim 3, wherein the local agitation at the bottom of the seeded
precipitation tank is an agitation by using rotating blades.

7. The process of claim 3, wherein the local agitation with a mechanical device at the bottom of the seeded precipitation tank is a local agitation by using one layer of rotating blades at the bottom of each seeded precipitation tank, and the agitation intensity is sufficient to maintain the aluminum hydroxide particles at the bottom of the seeded precipitation tank in a suspended state without deposition at the bottom of the seeded precipitation tank.