

DESCRIPTION

Process for Producing Calcium Hydroxide

TECHNICAL FIELD

The present invention relates to a process for
5 producing calcium hydroxide having a large specific
surface area.

BACKGROUND ART

Known processes for producing calcium hydroxide
include the so called dry slaking method comprising the
10 steps of supplying material calcium oxide into a slaking
apparatus; adding water in an amount of 1.3 to 2 times
the stoichiometric amount needed for hydrating calcium
oxide into calcium hydroxide; vigorously agitating the
calcium oxide and water so as to carry out slaking; aging
15 the reaction compound in an aging apparatus under
stirring, thereby eliminating irregularity in slaking and
evaporating excess water; and if necessary, pulverizing
and classifying the obtained calcium hydroxide.

The calcium hydroxide produced by this method
20 generally has a moisture content of not more than 0.5%,
is in the form of powder consisting of particles having
irregular shapes and having sizes of not more than 150 μm ,
and has a small specific surface area.

To obtain calcium hydroxide having a large specific
25 surface area with high reactivity, it has been proposed
to add an alcohol or a surfactant to the water used for
slaking. However, this method is disadvantageous from

the view point of cost, because an equipment for recovering the alcohol is necessary and a measure for assuring safety must be taken.

SUMMARY OF THE INVENTION

5 Accordingly, an object of the present invention is to provide a process for producing powdery calcium hydroxide having a large specific surface area, which process can be performed using the conventional dry slaking equipment at a low cost.

10 The present inventors intensively studied to find that powdery calcium hydroxide having a large specific area can be obtained by firstly mixing powdery calcium oxide and an organic compound having at least one hydroxyl group, and then carrying out slaking.

15 That is, the present invention provides a process for producing calcium hydroxide comprising, in the order mentioned, the steps of mixing powdery calcium oxide and an organic compound having at least one hydroxyl group; and slaking the resulting calcium oxide admixed with said
20 organic compound so as to obtain powdery calcium hydroxide.

 By the process according to the present invention, calcium hydroxide having a large surface area may be obtained. The process can be carried out using an
25 equipment obtained by adding to the conventional slaking equipment an apparatus for adding the organic compound having at least one hydroxyl group and, as required, an

apparatus for heating water to be used for slaking, so that the process may be carried out at a low initial cost.

BEST MODE FOR CARRYING OUT THE INVENTION

In the first step of the process according to the present invention, an organic compound having at least one hydroxyl group is mixed with powdery calcium oxide which is a starting material.

As the organic compound having at least one hydroxyl group, polyols are preferred. The polyol preferably has a molecular weight of not more than 600, more preferably not more than 400. Preferred examples of the polyol include ethanalamines such as monoethanolamine, diethanolamine and triethanolamine; glycols such as ethylene glycol, diethylene glycol, triethylene glycol, polyethylene glycol, propylene glycol, polypropylene glycol and butylene glycol; and glycerins such as glycerin, diglycerin and polyglycerin. Among these, propylene glycol and triethanolamine are preferred and propylene glycol is best preferred. The organic compound having at least one hydroxyl group may be used individually or in combination.

The amount of the organic compound admixed with the powdery calcium oxide may preferably be 0.5 to 10 parts by weight, more preferably 1 to 3 parts by weight per 100 parts by weight of the powdery calcium oxide. If the amount of the organic compound is less than 0.5 parts by weight, the effect for increasing the specific surface

area is small, and if it is more than 10 parts by weight, the effect for increasing the specific surface area reaches plateau and so disadvantageous from the view point of cost.

5 The organic compound having at least one hydroxyl group may be mixed with the powdery calcium oxide by, for example, kneading these materials with a kneader, or by spraying the organic compound to the powdery calcium oxide with a spray in a mixer under mixing. Although it
10 is preferred that the organic compound is in the form of liquid, the organic compound may not necessarily be liquid as long as the powdery calcium oxide is coated or impregnated with the organic compound. To attain uniform mixing, the powdery calcium oxide preferably has a
15 particle diameter of not more than 1 mm.

 In the second step, water is added to the mixture so as to carry out slaking.

 The amount of water to be added to the mixture may preferably be 1.3 to 2 times the stoichiometric amount
20 needed for hydrating calcium oxide into calcium hydroxide as in the conventional dry slaking. In other words, water is used in an amount of preferably 42 to 64 parts by weight per 100 parts by weight of the calcium oxide used as the starting material.

25 Slaking may be carried out at a temperature of 100°C to 250°C for 1 minute to 30 minutes. It is not necessary to delay the slaking reaction by cooling the reaction

mixture or by using a retarder. In cases where calcium oxide having a relatively low activity or the temperature of the calcium oxide as a starting material is low as in the case where the process is carried out in winter, it is preferred to use water at 40°C to 80°C, thereby promoting the slaking reaction.

After the slaking, if necessary, the obtained calcium hydroxide is aged. The aging process may preferably be carried out at a temperature of 80°C to 250°C for 10 minutes to 1 hour under stirring. The aging may also be carried out by merely stirring the reaction product at room temperature.

The obtained calcium hydroxide preferably has a moisture content of not more than 1% by weight, more preferably not more than 0.5% by weight.

The obtained calcium hydroxide powder preferably has a particle diameter of not more than 1 mm, more preferably 0.5 to 150 μm .

In general, when calcium hydroxide is produced by a dry slaking apparatus, since the slaking reaction generates great heat in a short period of time, crystal faces of calcium hydroxide do not well develop, so that the particles of the obtained calcium hydroxide likely have irregular shapes.

On the other hand, it is known that in cases where water containing an alcohol is used for slaking, crystal layers of calcium hydroxide are peeled off each other

because of existence of the alcohol between the layers,
so that crystals in the form of thin plate having a large
specific surface area are obtained (Chemistry and
Technology of Lime and Limestone, second edition,
5 consultant Robert S. Boynton, John Wiley & Sons, INC., 42,
1980; Arai et al., "Synthesis of calcium hydroxide in the
form of hexagonal plate", Gypsum and Lime, 189, 17, 1984).
However, with this method, since the reaction proceeds
under competition of water and the alcohol, a large
10 amount of alcohol must be used to obtain the desired
effect, so that an equipment for recovering the alcohol
is required.

In the process of the present invention, it is
thought that the mechanism for producing calcium
15 hydroxide having a large specific surface area is the
same as in the above-mentioned known process (Robert S.
Boynton, *supra* and Arai et al., *supra*) wherein a mixture
of an alcohol and water is used. However, since the
organic compound having at least one hydroxyl group is
20 directly added to the calcium oxide as the starting
material so as to cover the surfaces of the calcium oxide
particles, the effect is strong, so that only a small
amount of the organic compound is required and so an
equipment for recovering the organic compound is not
25 necessary.

In cases where calcium oxide having a low activity
is used or the temperature of the calcium oxide as a

starting material is low as in the case where the process is carried out in winter, the reaction time needed for completing the slaking tends to be long, so that the specific surface area tends to be small. In such cases, as mentioned above, the reaction may be promoted by using warm water preferably at 40°C to 80°C thereby calcium hydroxide having a specific surface area as high as those obtained by using calcium oxide having a high activity may be obtained.

10 Examples

The present invention will now be described by way of examples thereof. The examples are presented for the illustration purpose only and should not be interpreted in any restrictive way.

15 Example 1

Quick lime (JIS Industrial Lime, quick lime of special grade) was pulverized to obtain powdery calcium oxide having a particle diameter of not more than 1 mm. The reactivity (tu) of the obtained calcium oxide powder determined according to DIN1060 was 2.7 minutes. To 100 parts by weight of the calcium oxide powder, 1.5 parts by weight of triethanolamine was added and the resultant was stirred. To the obtained mixture, 42 parts by weight of water (i.e., 1.3 times the stoichiometric amount) at about 20°C was added. Slaking was performed at room temperature for 5 minutes under stirring. Thereafter, the reaction product was aged by stirring the reaction

product at room temperature for 20 minutes to obtain powdery calcium hydroxide.

The apparent specific gravity, specific surface area and moisture content of the obtained calcium hydroxide powder were measured and the results are shown in Table 1 below. The apparent specific gravity was measured by using a commercially available powder tester (HOSOKAWA MICRON). The specific surface area was measured by the nitrogen gas adsorption method by using a commercially available BET specific surface area meter (Quick Surface Area Measuring Apparatus SA-1000 commercially available from SHIBATA KAGAKU KIKAI KOGYO). The moisture content was determined in terms of loss of weight at 110°C.

Comparative Example 1

The same procedure as in Example 1 was repeated except that the triethanolamine was not added to the calcium oxide powder but added to the water used for slaking. The results are shown in Table 1.

Comparative Example 2

The same procedure as in Example 1 was repeated except that the triethanolamine was not used. The results are shown in Table 1.

Example 2

The same procedure as in Example 1 was repeated except that the quick lime had a reactivity (tu) determined according to DIN1060 was 10.8 minutes. The results are shown in Table 1.

Example 3

The same procedure as in Example 2 was repeated except that warm water at about 60°C was used for the slaking. The results are shown in Table 1.

5 Example 4

The same procedure as in Example 1 was repeated except that propylene glycol was used as the organic compound. The results are shown in Table 1.

Table 1

	Example 1	Comparative Example 1	Comparative Example 2	Example 2	Example 3	Example 4
Apparent Specific Gravity	0.31	0.34	0.34	0.32	0.30	0.25
BET Specific Surface Area (m ² /g)	36	13	16	30	36	38
Moisture Content (wt%)	0.22	0.35	0.38	0.42	0.15	0.40



CLAIMS

1. A process for producing calcium hydroxide comprising,
in the order mentioned, the steps of:
mixing powdery calcium oxide and an organic compound
5 having at least one hydroxyl group; and
slaking the resulting calcium oxide admixed with
said organic compound so as to obtain powdery calcium
hydroxide.
2. The process according to claim 1, wherein said
10 powdery calcium oxide has a particle diameter of not more
than 1 mm; said organic compound is mixed with said
calcium oxide in an amount of 0.5 to 10 parts by weight
per 100 parts by weight of said calcium oxide; and said
slaking is performed by using water in an amount of 42 to
15 64 parts by weight per 100 parts by weight of said
calcium oxide.
3. The process according to claim 1 or 2, wherein said
slaking is performed by using water having a temperature
of 40°C to 80°C.
- 20 4. The process according to claim 1 or 2, wherein said
organic compound is a polyol.
5. The process according to claim 4, wherein said
polyol is triethanolamine, ethylene glycol or glycerin.
6. The process according to claim 5, wherein said
25 polyol is propylene glycol.

This Sheet Has Been Replaced

