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RECOMMENDED SPECIFICATION FOR QUICKLIME
AND HYDRATED LIME FOR USE IN THE
PURIFICATION OF WATER

[This is the eleventh of a series of specifications for the lime used in various chemical processes. To assist in the development of these specifications the bureau has called together an Interdepartmental Conference on Chemical Lime, composed of representatives of the Geological Survey and Bureau of Mines, of the Interior Department; the Bureau of Soils, Bureau of Chemistry, Forest Service, and Fixed Nitrogen Laboratory, of the Department of Agriculture; and the Chemical Warfare Service, of the War Department. The present specification is based on a draft originally prepared by W. D. Collins, of the quality of water division of the Geological Survey of the Interior Department and has been approved unanimously by the above conference.]

ABSTRACT

In the treatment of water for public supplies lime is used alone or with iron sulphate or aluminum sulphate to produce a precipitate which assists in the clarification of the water and in the removal of bacteria by filtration. Lime is used sometimes to partially soften the water. Lime and soda ash are used together for softening water. Quicklime is generally used in municipal plants and hydrated lime in smaller plants. For these purposes quicklime should contain at least 90 per cent available lime and hydrated lime at least 90 per cent available calcium hydroxide.

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I. GENERAL

1. DEFINITION OF LIME

Quicklime is the product resulting from the calcination of limestone. It will slake when water is added to it, and this slaking is accompanied by an evolution of heat, and increase in volume, and the formation of calcium hydroxide. Hydrated lime is a dry powder which is made by treating quicklime with enough water to satisfy its chemical affinity.

2. USE OF LIME IN WATER PURIFICATION

In the treatment of water for public supplies lime is used alone or with iron sulphate or aluminum sulphate to produce a precipitate which assists in the clarification of the water and in the removal of bacteria by filtration. Lime is used sometimes to partially soften the water.

Lime and soda ash are used together for softening water. Quicklime is generally used in municipal purification plants and hydrated lime in smaller softening plants.

3. QUALITY

The constituents other than calcium oxide ordinarily found in lime, and which include underburned and overburned lime, retard the slaking process. The presence of any inert material will thus introduce delays which reduce the efficiency of the equipment.

4. PACKING

Quicklime is shipped in bulk in carload lots or in wooden barrels or metal drums holding 180 or 280 pounds each, or in waterproof bags holding 180 pounds. Hydrated lime is shipped in paper bags holding 40 or 50 pounds net each.

5. MARKING

Each package, or each carload of bulk material, shall be legibly marked with the names of the consignor and the consignee, and with some means of identifying the particular contract on which the shipment is made. This information is in addition to that required by the Federal lime barrel law.

II. REQUIREMENTS

1. SLAKING

When lumps of quicklime are immersed in water, they shall disintegrate readily into a suspension of finely divided material.

2. COMPOSITION

The standard of composition for quicklime for use in water purification shall be a content of 90 per cent available lime;¹ for hydrated lime a content of 90 per cent available calcium hydroxide.

3. BASIS

The percentages enumerated herein are based on the sample taken at point of shipment.

III. SAMPLING AND TESTING

1. SAMPLING

The purchaser will bear all expense of sampling and testing. When quicklime is shipped in bulk, the sample shall be so taken that it will represent an average of all parts of the shipment from top to bottom, and shall not contain a disproportionate share of the top and bottom layers, which are most subject to changes. The sample shall comprise at least 10 shovelfuls taken from different parts of the shipment. The total sample taken shall weigh at least 100 pounds, and shall be crushed to pass a 1-inch ring, mixed thoroughly, and "quartered" to provide a 15-pound sample for the laboratory.

When quicklime is shipped in barrels, at least 3 per cent of the number of barrels shall be sampled. They shall be taken from various parts of the shipment, dumped, mixed, and sampled as in the above paragraph.

The sample of hydrated lime shall be a fair average of the shipment. Three per cent of the packages shall be sampled. The sample shall be taken from the center to surface of the package. The material so obtained shall be mixed thoroughly and "quartered" to provide a 2-pound sample for the laboratory.

When sampling quicklime or hydrated lime, it is essential that the operation be conducted as expeditiously as possible, in order to avoid undue exposure of the material to the air. The sample to be sent to the laboratory shall be placed immediately in an air-tight container, in which the unused portion shall be stored until the shipment has been finally accepted or rejected by the purchaser.

2. TESTING

Details regarding the complete analysis of lime are given in other papers of this series and in Bulletin 700 of the United States Geological Survey.

(a) AVAILABLE LIME.—Weigh 1.40 grams of quicklime or 1.85 grams of hydrated lime which has been carefully prepared and finely

¹ It is recommended that in the purchase of quicklime a bonus or penalty of 1½ per cent of the contract price be added to or deducted from the payment for each 1 per cent of available lime respectively, above or below the standard 90 per cent.

ground (passing a No. 100 sieve). Place in a 250 cubic-centimeter beaker, add 200 cubic centimeters of hot water, cover, heat carefully, and then boil for three minutes.

Cool, wash down cover, add two drops of phenolphthalein, and titrate with half-normal hydrochloric acid, adding the acid as rapidly as possible dropwise, stirring vigorously to avoid local excess of acid. When white spots appear, retard the rate of addition of acid somewhat, but continue until the pink color fades out throughout the solution for a second or two. Note the reading and ignore the return of color.

Repeat the procedure of paragraph 1 above, using (instead of the beaker) a one-half liter graduated flask carrying a one-hole stopper fitted with a short glass tube drawn out to a point, with the smaller end open and upward. Cool, add dropwise 5 cubic centimeters less acid than before, stirring vigorously. Call the number of cubic centimeters used "A." Grind up any small lumps with a glass rod slightly flattened at one end, dilute to the mark with distilled water, stopper, mix thoroughly for four or five minutes, and let settle for half an hour.

Pipette a 200 cubic-centimeter portion, add phenolphthalein and titrate slowly with half-normal hydrochloric acid until colorless on standing one minute. Call this additional number of cubic centimeters "B." The per cent of available lime in quicklime or of available calcium hydroxide in hydrated lime is $A + 2.5 B$.

IV. RETESTING

Notice of the rejection of a shipment based on these specifications must be in the hands of the consignor within 10 days after the receipt of the shipment at the point of destination. If the consignor desires a retest, he shall notify the consignee within five days of receipt of the notice of rejection. The original testing laboratory shall keep the sample sealed air-tight from the time they have taken out enough material for the original test until the expiration of the 15 days noted. The original testing laboratory shall agree to transmit the sample to any other laboratory for a retest at the direction of both of the contracting parties. The retest shall be at the expense of the consignor.

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