Lime

Lime, hydrated Lime and slaked Lime are all common names for calcium hydroxide [$Ca(OH)_2$].

It is used as a source of calcium and alkalinity in both water- and oil-base drilling fluids. Lime, a widely available commercial chemical, is an economical source of calcium (Ca^{2+}) and hydroxyl ions (OH^-).

Drilling fluid applications for Lime include: increasing pH; providing excess Lime as an alkalinity buffer; flocculating bentonite muds; removing soluble carbonate (CO_3^{2-}) ions; controlling corrosion; and activating fatty-acid, oil-base mud additives.

CAUTION: Lime is a strong base and will form high pH (alkaline) solutions. See product handling information.

Typical Physical Properties

Physical appearance	White powder
Specific gravity	2.2
pH (1% solution)	12.4
Solubility @ 20° C (68° F)	0.165 g/100 ml water
Bulk density	2,210.5 kg/m^3 (138 lb/ft^3)

Applications

Lime is used as an economical source of calcium for flocculating bentonite slurries (spud mud) for improved hole cleaning. Since it is only slightly soluble in water, it is used to maintain an excess of insoluble Lime in a wide range of both water- and oilbase systems. Excess Lime buffers pH; provides a reserve quantity of calcium to precipitate soluble carbonates; and activates fatty-acid, oil-base additives. Lime is used for both calcium and pH control in gyp and Lime systems. An alkaline pH which is buffered by excess Lime will prevent acidic conditions from occurring which can lead to accelerated corrosion from acid gases.

The solubility of Lime increases with increased salinity, but decreases with increased calcium, increased pH and increased temperature.

Normal treatments for Lime depend on the system. The three levels of Lime concentration are often described as:

Low Lime: 1.43 – 5.7 kg/m^3 (0.5 – 2.0 lb/bbl)

Medium Lime: 5.7 – 14.3 kg/m^3 (2.0 – 5.0 lb/bbl)

High Lime: 14.3 - 43.0 kg/m^3 (5.0 - 15.0 lb/bbl)

Lime precipitates soluble carbonate ions as calcium carbonate ($CaCO_3$) as follows:

$$Ca(OH)_2 + CO_3^{2-} \rightarrow CaCO_3 \downarrow + 2(OH^-) \ldots\ldots\ldots \text{(at pH >10.3)}$$

Lime (lb/bbl) = CO_3^{2-} (mg/l) x 0.000432 x F_w

Water-base: Excess Lime (lb/bbl) = 0.26 [P_m - (F_w x P_f)]

Oil-base: Excess Lime (lb/bbl) = P_{OM} x 1.3

Where: F_w = Water fraction from retort analysis (% water/100)

Advantages

- Widely available economical source of calcium and alkalinity

Toxicity and Handling

Bioassay information is available upon request.

Handle as an industrial chemical, wearing protective equipment and observing the precautions as described on the Transportation and Material Safety Data Sheet (MSDS).

Avoid exposure and handle only when fully protected. Lime is an alkaline material and can burn eyes, skin and respiratory tract, and may react violently with water or acids.

Lime should be added slowly to the mud system through a properly designed mud hopper. Do not mix Lime with other chemicals or through the chemical barrel (due to its limited solubility, it will settle).

Packaging and Storage

Lime is usually packaged in 22.7 kg (50 lb) and 25 kg (55 lb), multiwall, paper sacks; numerous other sack sizes are used.

Store in a dry area away from water and acids. Keep all containers sealed. Once a container is opened it should be used immediately. Lime is highly reactive and may be corrosive to certain materials. Spills should be cleaned up using protective equipment as described on the MSDS and with the utmost care.

NOTE: Lime, being a commercial chemical, is available from numerous sources with various degrees of purity.

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