

Lecture 11

Calcium Nitrate

As a fertilizer, calcium nitrate has special advantages for use on saline soils because the calcium displaces the sodium that is absorbed by clay in soils. For this reason, it may be preferred for use in areas with soil salinity problems. In addition, calcium nitrate has the advantage of being non acid forming; it improves the physical properties of exhausted and acidified soils and can be used as a topdressing.

Other applications include explosives, pyrotechnics and inorganic chemical operations. In some countries it is used in sizable tonnages as a de icing agent (at airports).

Properties of calcium nitrate:

The properties of pure calcium nitrate anhydride are given in table.

Calcium nitrate forms four modifications:

-Ca (Na ₃) ₂	
-Ca (Na ₃) ₂ .2H ₂ O	(H ₂ O = 1.8%)
-Ca (Na ₃) ₂ .3H ₂ O	(H ₂ O = 24.8%)
-Ca (Na ₃) ₂ .4H ₂ O	(H ₂ O = 30.5%)

Properties of calcium nitrate:

Formula	$\text{Ca}(\text{NO}_3)_2$
Appearance	White crystalline
Molecular weight	164.10
Melting point	555.7°C
Density 20°C	2.36(anhydride)
Solubility:	
At 0°C	50.5%
At 100°C	78.4%
At 150°C	79.0%
Critical relative humidity[53];	
At 20°C	54.8%
At 30°C	46.7%

By the addition of ammonium nitrate, the double salt $5\text{Ca}(\text{NO}_3)_2 \cdot \text{NH}_4\text{NO}_3 \cdot 10\text{H}_2\text{O}$ is formed. The melting point of the double salt is 100°C - 105°C ; pH-value, 6-6.5.

Commercial Form, Storage and Transportation:

Calcium nitrate is traded as granulated, prilled or flaked products. The trend is toward granulated products. Typical specification of fertilizer grade is as follows.

Total nitrogen	15.5%
Ca (NO ₃) ₂ content	76.5 - 82%
NH ₄ NO ₃ content	4.5 – 7.2%
H ₂ O content	12 - 17%

Hardness is as follows:

Prills	2.0 + /-0.5 kg/grain
Drum granules	3.0 + /-0.5 kg/grain
Pugmill granules	3.5 + /-0.5 kg/grain

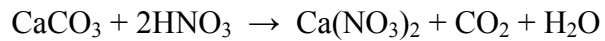
Screen analysis is as follows:

Flakes	95% - 99% between 2 and 5 mm
Granules	90% - 92% between 2 and 4 mm
Prills	93% - 95% between 1 and 3 mm

Bulk storage is to be avoided at all costs. Immediate bagging in multilayered bituminoid paper bags, PE-lined jute bags, or mono layer PE bags is mandatory.

As with other oxidizing nitrate fertilizers, precautions should be taken to avoid impregnation with organic material and contact with a heat source. Special storage and shipping regulations must be observed.

Calcium nitrate is produced by dissolving the calcium carbonate (lime stone) with nitric acid, according to the following reaction:



The lime stone is transported to the site as small size stones and lifted to the dissolving tower. The nitric acid is fed to the bottom of the dissolving tower and the formed calcium nitrate is fed to the settling tank. After settling, the excess acid is neutralized with ammonia. The nitrogen content is adjusted with ammonium nitrate. The fertilizer is produced in the liquid state and the nitrogen content of the final product is adjusted to the required specifications using ammonium nitrate.

Fig (14) illustrates the process flow diagram for the production of calcium nitrate fertilizers.

Fig (14) Process Flow Diagram for Calcium Nitrate

