

Gypsum vs: Anhydrite



WESTERN MINING
AND MINERALS

Agriculture uses approximately one million tons of "gypsum" products in California each year in crop production. Part of this tonnage is not actually gypsum but is a chemically similar material known as anhydrite. It is important for growers to understand how the differences between these products can affect their value as sources of available calcium and sulfate-sulfur.

How are these "gypsum" products the same?

Gypsum and anhydrite are both forms of calcium sulfate.

How are these "gypsum" products different?

Gypsum is calcium sulfate dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). Gypsum can also be called hydrated calcium sulfate. Anhydrite is anhydrous calcium sulfate (CaSO_4).

Gypsum is a soft crystal with a hardness rating of 2 and a density of approximately 2.3. Anhydrite is a hard crystal with a hardness rating of 3.5 and a density of approximately 3.0.

What do these differences mean?

To the Agricultural Growers...

Calcium is a major plant nutrient. Calcium is also vitally important in maintaining good soil structure and water infiltration. "Gypsum" products are by far the most important and affordable sources of available (soluble) calcium. When buying "gypsum" products, a grower sometimes has to choose between gypsum and anhydrite.

When the water of hydration is taken into account, gypsum and anhydrite have the same solubility. However, because of the hardness and density differences between gypsum and anhydrite, the rate of solubility for gypsum is always faster than the rate of solubility for anhydrite. In other words, the big difference between the two products is that calcium ions and sulfate-sulfur ions from gypsum are more quickly available than those from anhydrite after each of these materials is applied to the soil. For a given particle size, gypsum always dissolves much faster than anhydrite.

Gypsum products applied to the soil are only of value after they dissolve in the water in the soil. Only then are the calcium and sulfate-sulfur ions available to the soil and to plants growing in the soil.

Five to ten percent of the "gypsum" products used in California each year for crop production are dissolved in irrigation water to increase the calcium level. The amended water then delivers calcium ions and sulfate-sulfur ions directly to the irrigated soil. Only finely ground calcium sulfate dihydrate (gypsum) has been successfully used for this purpose. Anhydrite, even when finely ground, cannot dissolve quickly enough to be used in this process.

Recycled gypsum wallboard is becoming a more commonly available "gypsum" product. Only calcium sulfate dihydrate (gypsum) can be used to manufacture gypsum wallboard. This fact meant that a grower purchasing recycled gypsum wallboard for agricultural use is purchasing calcium sulfate dihydrate (gypsum).

To the State of California...

The State of California recognizes that calcium sulfate dihydrate is gypsum and that anhydrous calcium sulfate is not gypsum. This fact is reflected in the State labeling requirements for "gypsum" products.

When a "gypsum" product is labeled as gypsum, only the calcium sulfate dihydrate content of the product can be considered for determining the stated minimum purity guarantee for calcium sulfate dihydrate, calcium or sulfur. In this way, the consumer knows that the label claims refer only to gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). If this product is mined, the label will say "derived from mined calcium sulfate dihydrate or mined gypsum".

When a "gypsum" product contains anhydrous calcium sulfate (anhydrite), singly or in combination with calcium sulfate dihydrate (gypsum), the label for the product must refer to the stated minimum guarantee as a gypsum equivalent, not as gypsum. In this way, the consumer knows that the label claims refer to a product that is not, all or in part, gypsum. If some portion of the product contains calcium sulfate dihydrate, only that portion can be claimed on the label as gypsum. If this product is mined, the label will say derived from mined anhydrous calcium sulfate or mined anhydrite. In the case of a mixture, the label will say derived from mined gypsum and anhydrite.

Through its labeling requirements, the State of California requires that the consumer be informed of the true chemical makeup of "gypsum" products by not allowing anhydrite to be called gypsum, recognizing that gypsum and anhydrite are two distinctly different materials.