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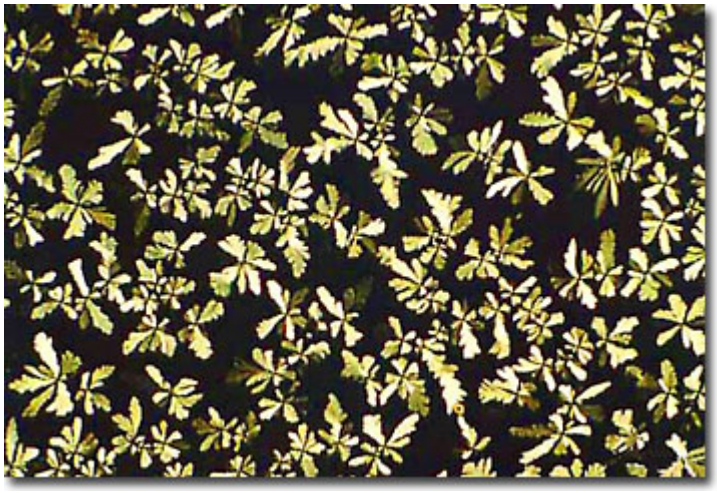
Loes Modderman

Soda-Boric Acid-Glycine Mixture

Baking soda, a form of sodium bicarbonate, is a naturally occurring substance found in all forms of life, where it helps maintain internal pH balance. Mined as soda ash (sodium carbonate) from a natural ore (**trona**) dug from the deserts of the Western United States, soda ash (or Soda-Solvay) can also be manufactured by bubbling a concentrated solution of sodium chloride plus lime with carbon dioxide and ammonia (the Solvay process).



To form sodium bicarbonate, the processed soda ash is dissolved into solution through which carbon dioxide is bubbled and almost pure sodium bicarbonate precipitates. Soda ash is also used in flat glass for automobile manufacture, building construction, pharmaceuticals, the metal industry, textiles, paper manufacturing, foods, and water treatment.

The white crystalline powder is used by consumers for cleaning, deodorizing the carpet or refrigerator, buffering the pool or hot tub, bread and cake leavening, and as a fire retardant in fire extinguishers. When baking soda is heated, it releases carbon dioxide (just as it does with rising dough) and becomes an effective fire extinguisher for grease and electrical fires, with the carbon dioxide cooling and smothering fire. The versatile chemical can even be used to cure heartburn, clean clothes, polish teeth, and when used as a paste on the skin, relieve burns, bites, and other irritations. When done, pouring the used sodium bicarbonate down the drain will help provide a stable pH to waste water, providing a suitable environment for the success of helpful decomposition bacteria. This environmentally-benign product should be preferred over household products sometimes termed "household hazardous wastes" that provide the same functions, only with toxic waste products such as strong acids, caustic lye (sodium hydroxide), and irritating chlorides and ammonia compounds.

When the 20 head mule trains left the deserts of California and Nevada, they were loaded down with "white gold" or borax from the legendary mines of Death Valley and the Mojave Desert. Borax (or hydrated sodium borate) is the mineral that serves as an ore for elemental boron (**B**) and a source of cleaning agents, industrial chemicals, and benign insecticides (except if you are the target roach). Along with the borax, **kernite** ore, the mineral source of boric acid, rode in those long wagon trains, to the processing plants and worldwide markets. Boric acid, also known as boracic acid, borofax, and **orthoboric** acid, contains atoms of

boron, hydrogen, and oxygen, and also refers to either **metaboric** acid or **tetraboric** (or **pyroboric**) acid, all three of which are considered hydrates of boric oxide. The boric acids are relatively benign to the environment, although their use poses some health risks to humans and it may pose problems for aquatic life. The white, cubic crystalline solid, which is slightly soluble in water, is characteristic of the metaboric form and forms tetraboric acid through dehydration at temperatures greater than 300 degrees Celsius. In contrast, orthoboric acid is colorless, weakly acidic, and forms triclinic crystals that are fairly soluble in boiling water and, when exposed to heat above 170 degrees Celsius, dehydrate into metaboric acid. Tetraboric acid is either a vitreous solid or a white powder and is soluble in water. Dissolving tetraboric or metaboric acid in water, quickly converts it back to orthoboric acid.

Boric acid and its mineral source, kernite, can be transformed in the processing plant into commercially valuable borax. Diluted in a water solution, boric acid is commonly used as an eyewash or mild antiseptic. It also finds uses in electroplating, leather tanning, and cosmetic manufacturing. In the Tuscan region of Italy, boric acid has been recovered from hot springs and vapors in the form of the mineral **sassolite** for thousands of years, but in the United States, it primarily is taken from the brine deposits in the dry lakebed of Searles Lake in California's Mojave Desert. Over the millennia, ground water has leached ore mineral and redeposited it in zones near the water table. Evaporation in this arid region enriches mineral accumulation in the dried lakes of this desert, with the closed basins precipitating gypsum, salts, and borates such as boric acid. Boric acid is used an industrial lubricant and more familiarly as ant traps and for roach control. Although potentially toxic to pets and their owners if they ingest the poison, boric acid is much safer than bioaccumulating, fat-loving, and carcinogenic chlorinated hydrocarbons like the banned, but highly effective DDT and Mirex. In the past, a mix of boric acid and honey was given to teething infants, but this no longer is favored because of stomach irritation and chronic toxicity risks. From the days of the ancient Greeks, boric acid and other borate compounds were used for cleaning, preserving food, and other household uses. When used in the cotton batting of mattresses, boric acid is very effective at controlling dust mites, mold and mildew, thus preventing allergic reactions and illness. As a side benefit, boric acid make the bedding fiber more flame- and smolder-resistant.

Glycine, often represented as **Gly** in biochemistry textbooks, is chiefly responsible for inhibiting motor neurons. When impaired, glycinergic inhibition leads to spastic and hypertonic disorders such as featured in spinal cord trauma, cerebral strokes, Parkinson's disease, and multiple sclerosis. Damage to the receptors for glycine on the motor neurons may point the way for new therapies for these debilitating diseases. As the simplest of all the amino acids found in life forms, glycine contains an amino group (nitrogen and hydrogen) and a carboxylic acid group (COOH) with a shared saturated carbon atom lying in between. Instead of a complex side chain attached to the central carbon atom, glycine features a single hydrogen atom.

In its free form, glycine can be ingested as a food additive or as a non-essential amino acid in the form of a dietary supplement. Claims by manufacturers involve triggering the release of oxygen required in cell reproduction, aiding in the creation of hormones necessary for a strong immune system, inhibition of neurotransmitters, and assisting in glycogen storage. Since glycine is manufactured in the healthy human body, it is rarely required as a supplement, as long as the precursors are available to the body's tissues and there are no interfering genetic disorders. Glycine is used by the body as a metabolic building block for nucleic acids (DNA and RNA), bile acids, porphyrins, creatine phosphate, and other amino acids. As the only amino acid found in humans that is not optically active, glycine is the second most common amino acid employed in building proteins and enzymes, only following alanine in relative abundance.

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