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FLUORINE COMPOUNDS, INORGANIC, SODIUM

Sodium has two fluorides, sodium fluoride [7722-88-5] and sodium bifluoride [1333-83-1].

1. Sodium Fluoride

Sodium fluoride, NaF, is a white, free-flowing crystalline powder, mp 992°C, bp 1704°C, with a solubility of 4.2 g/100 g water at 10°C, and 4.95 g/100 g water at 93.3°C. The purity of the commercial material is about 98%.

Sodium fluoride is normally manufactured by the reaction of hydrofluoric acid and soda ash (sodium carbonate), or caustic soda (sodium hydroxide). Control of pH is essential and proper agitation necessary to obtain the desired crystal size. The crystals are centrifuged, dried, sized, and packaged. Reactors are usually constructed of carbon brick and lead-lined steel, with process lines of stainless, plastic or plastic-lined steel; diaphragm, plug cock, or butterfly valves are preferred.

The salt is packaged in 45-kg multiwall bags or fiber drums of 45, 170, or 181 kg. It is available in both powdered and granular forms with densities of 1.04 and 1.44 g/cm^3 (65 and 90 lb/ft^3), respectively. Only the powdered grade is authorized by and registered with the EPA for use in pesticide formulations, with the further proviso that it must be tinted blue or green, or otherwise discolored. The word poison appears on all labels together with first-aid information.

Both sodium fluoride and sodium bifluoride are poisonous if taken internally. Dust inhalation and skin or eye contact may cause irritation of the skin, eyes, or respiratory tract, and should be avoided by the use of proper protective equipment (1).

Fluoridation of potable water supplies for the prevention of dental caries is one of the principal uses for sodium fluoride (see Water, municipal water treatment). Use rate for this application is on the order of 0.7 to 1.0 mg/L of water as fluoride or 1.5 to 2.2 mg/L as NaF (2). NaF is also applied topically to teeth as a 2% solution (see DENTIFRICES). Other uses are as a flux for deoxidizing (degassing) rimmed steel (qv), and in the resmelting of aluminum. NaF is also used in the manufacture of vitreous enamels, in pickling stainless steel, in wood preservation compounds, casein glues, in the manufacture of coated papers, in heat-treating salts, and as a component of laundry sours.

2. Sodium Bifluoride

Sodium bifluoride (sodium acid fluoride, sodium hydrogen fluoride), $NaHF_2$ or NaF·HF, is a white, free-flowing fine granular material. Its solubility in water is 3.7 g/100 g solution at 20°C, and 16.4 g/100 g at 80°C. It decomposes at temperatures above 160°C to give sodium fluoride and hydrogen fluoride. Commercial material is ca 99% pure. To prevent the formation of irritating dust, wetted products, containing 85–90% $NaHF_2$ and 10–15% water, are also in use.

The same reactants are used for manufacture as for sodium fluoride. An excess of acid is required to crystallize the bifluoride. The crystals are dewatered, dried, sized, and packaged. Cooling of the reaction is necessary to avoid over-heating and decomposition. Reactors and auxiliary equipment are the same as for sodium fluoride.

The dried salt is shipped in 45-kg multiwall bags and in 57-, 170-, and 180-kg fiber drums. Densities range from ca 0.70 g/cm^3 (44 lb/ft^3) to 1.2 g/cm^3 (75 lb/ft^3) for crystalline material.

Sodium bifluoride, by itself or in conjunction with other materials, is a good laundry sourbecause, in the concentrations used, it does not create a pH below 4.0 and thus causes no damage to textile fibers, although it removes iron stains. Leather (qv) bleaching and cleaning of stone and brick building faces are other uses for this material (3).

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