Kirk-Othmer Encyclopedia of Chemical Technology.

SODIUM IODIDE

Sodium iodide [7681-82-5], NaI, occurs as colorless crystals or as a white crystalline solid. It has a salty and slightly bitter taste. In moist air, it gradually absorbs as much as 5% water, which causes caking or even liquefaction (deliquescence). The solid slowly becomes brown when exposed to air because some iodide is oxidized to iodine. Water solutions are neutral or slightly alkaline and gradually become brown for the same reason. Aqueous solutions are stabilized with respect to oxidation by raising the pH to 8–9.5 (see Iodine and iodine compounds).

1. Properties

Sodium iodide crystallizes in the cubic system. Physical properties are given in Table 1 (1). Sodium iodide is soluble in methanol, ethanol, acetone, glycerol, and several other organic solvents. Solubility in water is given in Table 2.

Below 65°C, sodium iodide is present in aqueous solutions as hydrates containing varying amounts of water. When anhydrous sodium iodide is dissolved in water, heat is liberated because of hydrate formation, eg, $\Delta H = -174.4$ kJ/mol (-41.7 kcal/mol), when the dihydrate is formed. At room temperature, sodium iodide crystallizes from water as the dihydrate [13517-06-1], $NaI2H_2O2H_2O$, in the form of colorless prismatic crystals.

2. Manufacture

Bulk production of *United States Pharmacopeia* (USP) and reagent grades is based on the reaction of sodium carbonate or hydroxide with an acidic iodide solution, typically hydriodic acid or a metal iodide. After removal of chemical impurities, the solution is filtered and concentrated. Evaporation gives the anhydrous NaI. Controlled cool-down produces either the dihydrate or the pentahydrate [81626-33-7].

Essentially no waste products are formed in the USP process if hydriodic acid and either sodium hydroxide or sodium carbonate are used as reactants. Water results from use of the former; a mole equivalent quantity of carbon dioxide is produced from the latter reagents. Higher quality grades may require some purification steps which may result in wastes from the treatment. Disposal of these impurities must then be carried out.

3. Economic Aspects and Uses

The market price of USP sodium iodide generally follows the price of crude iodine multiplied by a factor of 1.8–2. Higher purity grades are only marginally related to the price of crude iodine.

Table 1. Physical Properties of Sodium Iodide[a]

Property	Value
mol wt	149.895
mp, °C	651
bp, °C	1304
d_4^{25}, g/cm^3	3.667
specific heat, J/(kgK)[b]	
at 0°C	350
50°C	360

[a]Ref. 1.
[b]To convert J to cal, divide by 4.184.

Table 2. Aqueous Solubility of Sodium Iodide

Temperature, °C	NaI g/100 g H_2O
0	158.7
20	178.7
40	205.0
60	256.8
70	294
80	296
100	302
140	321

The principal use of sodium iodide is in scintillation crystals, which are used for gamma-ray counters (2), and in medicine as the detectors in computer-assisted tomography (CAT) scan and positron emission tomography (PET) equipment (3). A small amount is used in the wet extraction of silver, in iodized salt (see Food additives), animal feeds to prevent hoofrot (see Feeds and feed additives), photographic chemicals, as an antiinfectant for body drapes in medicine, and in the manufacture of organic chemicals. It has also been used in cloud seeding and in halogen discharge lamps.

USP XXII specifies that sodium iodide contains 99–101.5% NaI, calculated on an anhydrous basis (4). It is used interchangeably with potassium iodide as a therapeutic agent, except where sodium ion is contraindicated (see Potassium compounds). Intravenous sodium iodide formulations have been used for a variety of diseases, from thyroid deficiency to neuralgia (see Thyroid and Antithyroid preparations). However, these solutions are no longer listed in the *NF XVII* (4), indicating that their therapeutic value has not been satisfactorily demonstrated.

Veterinary uses of sodium iodide include the treatment of horses, cattle, sheep, swine, and dogs for various afflictions (see Veterinary drugs).

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Related Articles

Iodine and iodine compounds; Thyroid and antithyroid preparations; Veterinary drugs