


Research Group



Info Mine 

Review of the CIS sodium cyanide market

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Summary

In the below report the review of the sodium cyanide market in the CIS (technology, volumes of manufacture and the basic manufacturers, export - import transactions, the price review and structure of cyanide consumption) is presented. The data included embraces the 8 latest years (1997-2005) as well as prospects of the domestic market development.

Having conceded in 2003-2004 the positions in the Russian sodium cyanide market at the present moment Joint-Stock Company "Corund Ltd." (the only Russian sodium cyanide manufacturer) adopted the policy of consumer's solicitation. The enterprise tries to return the lost share of the market with the help of the state. In October, 2005 under the statement of Joint-Stock Company "Corund Ltd. " the Ministry of economic development and trade of Russian Federation (MEDT) started antidumping investigations with respect to Republic Korea and Japan. However the gold mining companies - the basic cyanide consumer's - regard the antidumping investigation without any enthusiasm. If the market is closed through the duties it will not lead to the refusal of the import goods but only to gold miners' costs growth. The extremely unprofitable geographical position of "Corund Ltd." prevents the enterprise from developing cyanide business effectively.

Introduction

Sodium cyanide (NaCN) is a white powder, plates, paste, or hygroscopic crystals, with a weak smell of bitter almonds. At temperature below 14,5°C there is a modification of orthorhombic lattice, at a higher temperature - a cubic face-center lattice. Sodium cyanide is well dissolve in water (solubility of 36,8% by weight at 20°C), is dissolved in methanol (6,05% by weight at 15°C). Poorly dissolved in liquid sulfur dioxide, ethanol, dimethyl formamide. In table 1 the basic sodium cyanide physical properties are presented.

Table 1: Physical properties

Physical properties	Characteristic	Measurement	Value
Density	ρ	g/sm ³	1,6
Temperature of fusion	T of fusion.	°C	563,7
Temperature of boiling	T of boiling	°C	1497
Thermal capacity	Cp°	J/(mole*K)	69,7
Enthalpy formations in standard conditions	ΔN° form.	κJ/mole	89,87
Enthalpy polymorphic transition	ΔN° tr.	kJ/mole	2,93
Enthalpy fusion	ΔN° fu.	κJ/mole	15,4
Enthalpy evaporations	ΔN° ev.	κJ/mole	156
Maximum permissible concentration (recalculation by HCN):			
In air of a working zone	MPC	mg/m ³	0,3
In atmospheric air			0,01
In water		mg/l	0,1

Sodium cyanide is highly toxic, causes asthma owing to a paralysis of tissue respiration that leads to cardiac decompensation. A fatal doze is - 0,1. Poisonings can occur through inhalation of dust, casual substances swallowing, and also through skin, in particular, if it's damaged by fine wounds or skin diseases. Premises where work with sodium cyanic is conducted, should be equipped with a powerful forced-air and exhaust ventilation. All persons dealing with sodium cyanic, should have special gas masks and overalls (overalls, boots, a headdress, and rubber gloves).

Sodium cyanide chemical properties provide for its industrial application. So at fusion with sulfur sodium thiocyanate (NaNCS) is formed, with halogens - halogen cyanides, with alkyl and aryl halogen cyanides - nitrites of corresponding carboxylic acids, with salts of transition metals - cyanide complexes (for example Na[Au(CN)₂]). In dissolution with liquid ammonia sodium cyanide forms amines, for example, NaCN·5NH₃.

In water solution sodium cyanide is gradually hydrolyzed with extraction of a hydrocyanic acid. At heating in water solution it dissolves to NH₃ and HCOONa.

Sodium cyanide is oxidized with oxygen up to NaNCO or Na_2CO_3 . In tight container the substance is stable, but in damp air it is decomposed to carbonic acid up to Na_2CO_3 and HCN .

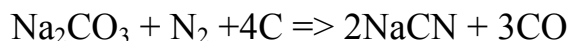
Sodium cyanide is manufactured by the industry as pressed briquettes or crystal powder. It is applied in gold or silver extraction from ores with the help of selective leaching; as a cyaniding agent in manufacture of nitrites, isonitriles, dyes; for the increase of surface strength, wear resistance and fatigue resistance of steel products - the so-called cyanidation process (saturation of surface layers of steel products with carbon and nitrogen at the same time through heating in the cyanide containing melt). Besides it is used in soldering and liquid cementation of metals, in bronzing and zinc coating, in mirrors silvering, in photo, lithography, in manufacture of pharmaceutical preparations, for pest control in agriculture, in flotation processes (in particular, for galenite separation from sphalerite and pyrite from chalcopyrite).

I. Sodium cyanide production and raw materials used in the industry

I.1. Technology of цианида sodium production

There is a set of methods of sodium cyanide production, depending on the initial reagents.

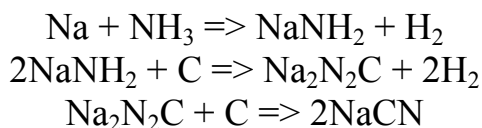
1. In 1775 **Sheelle** received sodium cyanide through interaction of coke with soda in nitrogen atmosphere:



2. Calcium cyanamide calcination in a mix with sodium chloride and carbon:



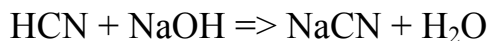
3. Transmission of gaseous ammonia above the fused sodium with the subsequent burning of derived sodium amide with coal at 500-600°C:



4. Heating of soda, coal and 20 % ammonia solution mix:



5. The basic way of manufacture - neutralization of hydro cyanide acid with alkali with the subsequent evaporation of water solution and drying of a deposit:



Sodium cyanide is extremely poisonous substance very dangerous to people and animals. Therefore the corresponding equipment is used for its manufacture interfering with penetration of this substance into the environment.

The process of manufacture used by the CIS enterprises is a batch one, and when these traditional technologies are employed the raising dust powder turns out during the process of production, the basic substance content - 88 %. Continuous process at which the basic substance content achieves 98 % is applied abroad. Sodium cyanide is pressed and granulated, and also bricketed for reduction in harmful influence of dust.

I.2. Principal raw materials suppliers

In the CIS sodium cyanide production capacities are available at 3 enterprises only:

- Joint-Stock Company "Corund Ltd. " (Dzerdzhinsk, the Nizhniy Novgorod area, the Russian Federation);
- Joint-Stock Company " Navoyazot " (Navy, Uzbekistan);
- Joint-stock company " Azot" (Rustavy, Georgia).

Total capacity of sodium cyanide production in the CIS adds up to 31,8 thousand t, 9,7 thousand t in the Russian Federation.

The analysis of activity of the enterprises shows, that in the CIS sodium cyanide is obtained only with a method of hydro cyanide acid neutralization. Raw materials used for sodium cyanide manufacture are a hydro cyanide acid and sodium hydroxide.

At the enterprises of Joint-Stock Company «Navoyazot» and Joint-Stock Company "Azot " in the process of manufacture of acrylic acids nitrile hydro cyanide acid is produced as a by-product used further for cyanides manufacture. Joint-Stock Company " Orgsteklo " located in Dzerdzhinsk has a work-shop for manufacture of a hydro cyanide acid, capacity - 15 thousand tons. Thus, the basic component of sodium cyanide manufacture - a hydro cyanide acid is produced at the plants themselves or at enterprises located nearby.

The second component for sodium cyanide manufacture - caustic is either manufactured at the plants (in particular at "Navoyazot") or delivered from other chemical enterprises, including from abroad.

In Russia sodium hydroxide (caustic) is manufactured at 16 enterprises. The largest manufacturers are: Joint-Stock Company " Kaustik " (Sterlitamak), production capacity comes to 289 thousand t per year; Joint-Stock Company " Kaustik " (Volgograd) capacity is 210 thousand t, " Kirovo-Chepetsky Khemitchesky Kombinat" (the Kirov region) - 134 thousand t, Joint-Stock Company " Sayanskhimplast " (Irkutsk region) - 115 thousand t, Joint-Stock Company "Kaprolaktam " (Dzerdzhinsk, the Nizhniy Novgorod region) - 132 thousand t.

In Georgia sodium hydroxide is not produced. " Azot " in Rustavy gets alkali from Azerbaijan and Russia.