

SODIUM SULPHIDE PLANT IN MONGOLIA PROJECT

Investment highlights	<ul style="list-style-type: none"> ✓ The market for the sodium sulphide is growing at 7% per annum worldwide. ✓ At full capacity of processing, EMC, which is our important consumer, imports 12,000 tons dry sodium sulphide (60-65%). ✓ Another large consumer of the sodium sulphide in Mongolia are the leather processing factories. They consume 6000 tons sodium sulphide per year. ✓ The initial expected annual capacity of the plant will be 21000 tons of the sodium sulphide with 320 working days and price at the plant will be 620 USD per ton.
Project Implementer	<p>The National chemicals LLC established in 2006 for construction and operation of chemical plant in order to meet the growing market demand in sodium sulphate (Plant A) and sodium sulphide (Plant B) and their by-products for domestic and international markets.</p>
Sector and industry overview	<p>Sodium Sulphide is used as a solvent in extractive and metallurgical <u>industries, and technological ingredients in leather processing, knitting and</u> wood processing industries. Moreover, it also is used in cosmetic, paper, fertilizer, paint and plastics processing and from recently in water treatment and air cleaning.</p> <p>The largest importer and consumer of sodium sulphide in Mongolia is Erdenet Mining Corporation (EMC), the JVC between Russian and Mongolian governments. Located 370 kms northwest from Ulaanbaatar city, the plant produces copper concentrate since 1974 and plays the most important role for the economy of the country since, EMC imports sodium sulphide in powder dissolves it into liquid form in order to add to floatation process as an ingredient.</p> <p>At full capacity of processing, EMC imports 12,000 tons dry sodium sulphide (60-65%). It has in-house facility that converts dry sodium sulphide into liquid form. Sodium sulphide is used as the depressant of the copper and iron bearing minerals which due to a rather high consumption (0.34 kg/t or higher) constitutes one of major cost items of the plant (i.e., 58% of total reagents cost).</p> <p>The market for the sodium sulphide is growing at 7% per annum worldwide. In Mongolia there will be another large consumer of the sodium sulphide, as the world largest reserve of copper was found recently in the south part of Mongolia (OyuTolgoi copper mine). There will be an enrichment plant similar to EMC, only larger capacity and a smelter in 5-6 years from now.</p> <p>The business environment in Mongolia is getting better and effective tax rate is reduced substantially from the Jan 2007, (almost flat 10% tax).</p>

Project Introduction	✓ Project location: near “Tsaidam” deposit, TseelSoum, TuvAimag
	✓ Deposit Resource: 2.6 Million tons/25 years/
	✓ Main Products: <u>Sodium sulphate, Sodium sulphide</u>

The initial expected annual capacity of the plant will be 21000 tons of the sodium sulphide with 320 working days and price at the plant will be 620 USD per ton. The cost of product 500 USD.

The Plant A will produce sodium sulphate. This is sodium salt of sulfuric acid. With an annual production of 6 million tones, it is one of the world's major commodity chemicals. Anhydrous, it is a white crystalline solid of formula Na_2SO_4 ; the decahydrate $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ has been known as Glauber's salt or, historically, salt mirabilis since the 17th century. Sodium sulphate is mainly used for the manufacture of detergents (50% of total consumption) and in the Kraft process of paper pulping. About two thirds of the world's production is from mirabilite, the natural mineral form of the decahydrate, and the remainder from by-products of chemical processes such as hydrochloric acid production.

The National chemicals LLC has license for producing mirabilite from the Lake Tsaidam in Zaamarsomon, Central aimag. It is 180 Kms (110Km road and 70Km off road) west of Ulaanbaatar. The Plant A for production of sodium sulphate will be located at the site of the lake where the related infrastructure (road, electric power and water) has been created at the moment. The expected annual capacity of the plant A is 30,000 ton. The selling price of the product will be 90USD per ton at the plant. The National chemicals LLC had visited similar plants in China and Italy.

The Plant B will produce sodium sulphide out of final product of Plant A: sodium sulphate with coal reaction. The location will be the same the first plant at the lake. The reaction between commercial sodium sulphate and coal gives sodium sulphide and some other by-products. Sodium sulphide is the name used to refer to the chemical compound Na_2S but more commonly its hydrate $\text{Na}_2\text{S} \cdot 10\text{H}_2\text{O}$. Both are colorless water-soluble salts that give strongly alkaline solutions. When exposed to moist air, Na_2S and its hydrates emit hydrogen sulphide, which smells much like rotten eggs. Industrially Na_2S is produced by reduction of Na_2SO_4 with carbon, in the form of coal: $\text{Na}_2\text{SO}_4 + 2 \text{C} = \text{Na}_2\text{S} + 2 \text{CO}_2$

Before the project implementation we have the production process carefully planned. Our production facilities have passed the test well. The calibration and experimental production process show very optimistic results for inputs and outputs of the project.

Since September 2013 we produced 2900 ton sodium sulphate and 1030 ton sodium sulphide. The Production time was quite short. We spent only 20 days for this amount. That means we can produce, which we planned.

We delivered the end product 1020 tonsodium sulphide/ to Erdenet Mining Corporation (EMC) for experimental consumption.

According to the test result from the laboratory of Erdenet Mining Corporation and consumption in production was found that our product is better than Chinese product /for example: the recovery/.

According to the environmental impact assessment has been established this plant environmentally friendly. There isn't any adverse Impact on the environment.

Financial snapshot Total required investment: 13 million dollar.
Thereof:

- Equity capital: 4.8 million dollar,
- Loan capital: 8.2million dollar,

Running Time of Project: over 25 years
Payback period: 6 years

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