

NON-TECHNICAL NOTES

REFINING OF BALUCHISTAN SULPHUR ORE

Important reserves of native sulphur in Pakistan occur at Koh-i-Sultan. The Geological Survey of British India proved them to be feasible for exploitation in 1940. Out of a reserve of 1,50,000 tons of the ore, 66,300 tons were excavated till 1945, at a cost of about Rs. 30 lakhs. Due to unfavourable geographical and climatic conditions, a good amount of money had to be spent on means of transport of the ore. The main loading camp was at Batal. Later, a 2-mile roadway was installed between Miri deposits and Batal loading camp, at a cost of about Rs. 4 lakhs. This was disposed of at a nominal price just before the Independence and was removed to India.

At present, the place is in the same condition as it was before the war-time operations. All the roads have been washed away by the nullas. Nothing is left of the buildings except a few ruins. Even the road between Nokundi and the foothills of Koh-i-Sultan has been damaged.

About 15,000 tons of the crude sulphur ore belonging to two private concerns are still lying at Nokundi railway station; 85,000 tons of the ore averaging about 50% sulphur is available for excavation and subsequent refining. This figure may be low, as further reserves may be available underneath or elsewhere.

It is difficult to give a correct idea of the cost of excavation of the ore. The original scheme submitted by Mr. E.R. Gree in 1941, anticipated an expenditure of Rs. 5,22,335 for quarrying 25,000 tons good quality ore (15,000 tons from Batal, 10,000 tons from Miri) and delivering it into railway wagons at Nokundi within six months. This included capital cost of Rs. 41,780 out of which Rs. 12,960 could be recovered on the completion of the operation. Average cost per ton of ore, delivered into railway wagons at Nokundi was estimated at Rs. 19/2 and Rs. 22/5 for Batal and Miri, respectively.

In view of the fact that the cost of living and consequently the cost of labour as well as the capital cost have increased considerably as compared with 1941, the excavation of the ore today would naturally cost more.

The sulphur is present in the crude ore in association with fine amorphous silica and sometimes with gypsum and alum. Methods tried to refine this ore include Calcarroni, steam liquation, froth floatation, zinc chloride method, etc. None of these could prove economically feasible so far, on account of one or more of the following reasons :

1. Fineness and amorphous state of the associated gangue material.
2. Unsatisfactory recovery of sulphur.
3. High cost of operation.
4. Specialized technique and equipment for operation.

To give an idea about the high capital cost, the most recent Chemicoprocess of America which comprises steam liquation and froth floatation, involves for a 10-ton plant, a cost of about \$7,00,000 in America. It is roughly estimated that the cost of refining would be more than Rs. 250 per ton.

Soon after the Independence the importance of sulphur to the country as a strategic raw material was realized. Some practical efforts were made to solve this problem. These efforts got an impetus by the sudden announcement of American sulphur suppliers to restrict the export because of their dwindling reserves. Consequently work carried out under a scheme sponsored by the Central Government in December 1950, and later continued under the P.C.S.I.R., has resulted in the development of a simple method for the refining of sulphur. A special feature of this process is that it does not require any specialized equipment or technique.

The total capital investment for a unit producing 1,500 ton per annum is about Rs. 2,00,000. The average cost of the finished product (sulphur) is about Rs. 223/8/- per ton.

Process

The process essentially consists of grinding the ore to a certain mesh size and heating it with a cheap chemical at 120-130°C. for a short time. Sulphur melts to form globules. The coalescence is facilitated by the addition of a small quantity of a surface active agent. The colour of the globules indicates when the process is complete.

The mass is then quenched and solidified sulphur globules together with the gangue are allowed to fall in a column of water in a specially designed separator, whereby the globules get separated from the gangue in settling tanks and can be used over and over again. The sulphur recovered is more than 99% pure. The recovery is about 90-95%.

The equipment required consists of the following : jaw crusher, ball mill, electric motors, galvanised iron sheet tanks, melting pans, separators, furnaces, sieves and driers, settling tanks, and generators.

The process is covered by Pakistan Patents 107149 and 108018

Pre-Construction Cost Estimation

(Production Capacity = 1,500 tons per year)

<i>Capital expenditure :</i>	Rs.	
Equipment ..	72,000	
Building ..	30,000	
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	10,200	
<i>Running expenditure :</i>		
Raw Materials ..	1,97,375	
Direct Labour ..	45,000	
Power ..	30,000	
Contingencies ..	2,000	
Depreciation @ 15% ..	15,300	
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	2,98,675	
<i>Direct expenses :</i>		
Establishment ..	22,875	
Promotion of the project at ½ % on Rs. 1,80,000/- (running expenditure for 3 months plus capital expenditure) ..	4,500	
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	27,375	
Interest on capital @ 6% on Rs.1,80,000	10,800	
Insurance @ 2½ % on Rs.2,99,375 ..	7,485	
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Cost of production of 1500 tons of sulphur	3,35,335	
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Average cost Rs. 223/8/- per ton.		

JUTOID WATERPROOF MATTING

Water-proofing of roofs is a necessity in a great many cases where light concrete, thatched roofings or damp-proof courses are used. Uptil now these demands have been met by importing certain products, which are a drain on the foreign exchange and are too high priced to be directly available to the masses or for the rehabilitation of displaced persons. A process has been evolved at the Central Laboratories of the Pakistan Council of Scientific and Industrial Research for the production of a cheap water-proof matting of jute fabric base and other indigenous raw materials with the help of simple equipment which can be locally fabricated.

This material has been tested to withstand the severity of temperatures of the order of 170°F. without any bleeding and has also been subjected to water-jet quenching for determining thawing effects. Besides, it has been exposed to local climatic conditions for considerable periods without appreciable deterioration.

The total estimated capital investment for a plant with an annual production capacity of 6,00,000 sq. ft. Jutoid matting is Rs. 1,29,291. The cost of production of the matting works out to 3½ annas per sq. ft. The prevailing prices for the material used for similar purposes fluctuate between 12 annas to a rupee per sq. ft.

Pre-Construction Cost Estimation

<i>Capital expenditure</i>	Rs.
Equipment	9,900
Building	7,000
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	16,900
<i>Direct expenses :</i>	Rs.
Raw Materials	97,500
Direct Wages	9,900
Power	1,000
Contingencies	1,000
Depreciation at 10% on capital ..	1,690
<i>Indirect expenses :</i>	
Establishment	9,720
Promotion of the project at 2½% on Rs. 50,000	1,250
<i>Selling expenses</i>	4,200
Insurance at 2½% on Rs. 41,275 ..	1,031
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	1,29,291

Total cost of producing 6,00,000 sq. ft. of Jutoid comes to Rs. 1,29,291.

Cost of production per sq. ft. 3 ½ annas.

AIR ENTRAINING AGENT FOR THE PRODUCTION OF FOAM CONCRETE

Air entraining agents are employed for the production of light-weight concrete, used in factories for thermal insulation or where lightness is demanded irrespective of cost.

While there is a very substantial demand for light-weight concrete as a constructional material, particularly in factories, its use in the country is limited on account of the non-availability of air-entraining agents locally.

As a result of the work carried out in the Central Laboratories, a process has been developed for the production of an air-entraining agent from hair and other proteinous waste materials.

The total capital investment in a unit of production with a capacity of 125 gal. per day to give 2000 cu. ft. of light weight concrete is estimated to be about Rs. 17,000 with an average cost of Rs. 4/4/- per gal. of the air-entraining agent.

The process consists of the following unit operations: cooking under pressure and filtering.

Equipment and Raw Materials

Pressure cooker (150-litre capacity), plate and frame filter press with hand pump, tanks (200-litre capacity), and kettle (100-litre capacity).

Pre-Construction Cost Estimation

(Production capacity: 37,500 gal. per annum or 125 gal. per day)

<i>Capital expenditure</i>	Rs.	Rs.
Equipment ..	12,000	
Building ..	16,000	
		28,000
<i>Direct expenses per annum</i>		
Raw materials ..	87,228	
Direct wages ..	7,920	
Containers ..	37,500	
Power ..	4,000	
Contingencies ..	5,000	
Depreciation @ 10% ..	2,800	
		1,44,448

Indirect expenses

Establishment	6,120
Promotion of the project @ 2 ½% on Rs. 67,000 (capital expenditure plus running expenditure for 3 months)	1,675

	7,795
<i>Selling expenditure</i>	1,800
<i>Interest on capital @ 4% on Rs. 67,000</i>	2,680
<i>Insurance @ 2 ½% on Rs. 1,15,228</i> ..	2,880

Cost of production of 37,500 gals. per annum of air-entraining agents	1,59,603
Average cost-Rs. 4/4 per gal.	

PRINTING AND OTHER OIL-BASED INKS

Printing and other oil-based inks are mainly composed of a pigment material and a vehicle, usually a drying oil, in which the pigment is distributed in a finely divided state. But to prepare a stable composition of the proper consistency, adhesion, flow, colour and brilliancy involves a specialised technique and rigid control of the process and formulation. The introduction of automatic printing machine demands still greater perfection and uniformity in ink composition. The manufacture of ink is, therefore, a highly developed art, but on account of its large and universal demand, good quality printing and other inks are produced in almost all advanced countries. Pakistan, however, does not have a well established ink manufacturing industry, with the result that almost all types of printing and other inks required in the country are being imported. Investigations were, therefore, taken up in the Central Laboratories of the Council of Scientific and Industrial Research on various types of oil-based inks, such as stamp cancelling, duplicating and news inks. As a result of these investigations it has been possible to evolve various compositions for these inks, which dry mainly by absorption. They are almost exclusively based on indigenous raw materials and compare favourably with the best quality imported inks of each of these categories.

The estimated demand of the various kinds of inks based on the figures of import is as given below :—

1. Postal ink ..	10,000 lbs.	approx.
2. Duplicating ink ..	50,000 "	"
3. News printing ink ..	100,000 "	"

A unit with a production capacity of the above indicated quantities of inks is estimated to require the total capital investment of about Rs. 2,00,000.

The average cost of the ink in a unit of this size would be about Rs. 1/2 per lb. inclusive of overhead expenses, as compared to the prevailing market price of these inks indicated below :—

1. Postal ink .. Rs. 4/-/- to 5/-/- per lb.
2. Duplicating ink .. Rs. 9/-/- to 10/-/- per lb.
3. News ink .. Rs. 4/-/- to 8/-/- per lb.

Process and Equipment

The process consists essentially of preparing a stabilising varnish which is thoroughly mixed with other ingredients, the whole mass being then passed through a roller mill.

The equipment required is : edge runner, mixer, single and triple roll mills, straining and sieving machine, filling machines, and storage tanks, pumps, electric motors, laboratory testing equipment, etc.

All of these have to be imported from abroad.

Raw Materials

The raw materials involved are : rosin, oil (vegetable and mineral oils), pigment and chemicals.

All the raw materials are available in the country, except carbon-black, which represents only about 6.5% of the total value.

Pre-Construction Cost Estimation

Production Capacity

News ink ..	1,00,000 lbs./annum
Duplicating ink ..	50,000 lbs./annum
Stamp cancelling ink ..	10,000 lbs./annum

Capital expenditure	Rs.	Rs.
Equipment ..	1,17,000	
Building ..	41,200	
		1,58,200
Say ..	Rs. 1,60,000	

Direct expenses per annum		
Raw materials ..	59,000	
Direct wages ..	14,220	
Containers ..	40,000	
Power ..	3,000	
Contingencies ..	5,000	
Depreciation @ 10% ..	16,000	
		1,37,220

Indirect expenses		
Establishment ..	21,900	
Promotion of the project @ 2½% on Rs. 2,00,000 (Capital expenditure plus running expenditure for 3 months). ..	5,000	
		26,900

Selling expenses ..	4,200
Interest on capital @ 4% on Rs. 2 lacs	8,000
Insurance @ 2½% on Rs. 2,19,000	5,475
Total cost of production of 1,60,000 lbs. of inks ..	1,81,795