

PRE-FEASIBILITY REPORT FOR THE PRODUCTION OF LIGHT WEIGHT AGGREGATE

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1. Introduction of Technology/Process/Product

Name of Technology/Process/Product:

Production of Lightweight Aggregate.

Summary:

Lightweight aggregate is a specialized construction material, produced by scientific processing of certain rocks/minerals. Lightweight aggregate weighs less than the usual aggregate of sand, gravel and crushed rock. The material has been in use for specific construction in developed countries since many years. PCSIR Laboratories Complex, Peshawar has developed a process for pilot plant production of the lightweight aggregate from slate. The Complex has already produced and supplied 850 ton of the material for M/s Sachal Engineering Pvt. Ltd for application in the Khairabad bridge and. 80 ton for the construction of Sherpow bridge in Lahore on the recommendation of NESPAK. Besides this, 11 ton was produced for Council for Works and Housing Research (CWHR) Karachi, and 22 ton for National Physical and Standard Laboratories (NPSL) Islamabad.

Project brief (*Local/International Perspective*)

The investigation has revealed that extensive deposits of shale and slate as potential raw materials for lightweight aggregate are present in parts of Margalla, Cherat and the Attock ranges respectively in between the region of Islamabad and Peshawar. The chemical and mineralogical compositions of these materials are nearly consistent and their entire outcrops can be easily mined by open pit method to manufacture lightweight aggregate. Test results indicate that shale and slate can be bloated successfully at 1100 to 1200 °C respectively and the resultant bloated material becomes extensively lighter than the conventional aggregate. The expanded aggregate is hard, highly cellular and has a tough skin and uniform structural strength. If such an industry is established near to the deposit area, the product would be utilized for multi storey buildings, bridges, tunnels etc as well as exported to other developing countries. In this way a lot of foreign exchange could be saved. The establishment of processing plants in various areas provides

excellent employment opportunities. At present, PCSIR Laboratories Peshawar has the production capacity of 10 to 12 ton per day.

2. Main Parameters of Technology/Process/Product

Main Feature:

- Lightweight and greater strength.
- Fire resistance.
- Thermal insulation and moisture resistance.
- Sound insulation.
- Textured finished and workability.
- Resistance against earthquakes

Input (*Raw materials with specifications*)

Average chemical composition of slate:

SiO ₂	62.92 %
Fe ₂ O ₃	07.04 %
Al ₂ O ₃ + TiO ₂	18.79 %
Alkalies (CaO, MgO, Na ₂ O, K ₂ O)	06.22 %
<u>Loss on ignition</u>	<u>04.88 %</u>
<u>Total</u>	<u>99.98 %</u>

Average chemical composition of shale:

SiO ₂	56.35 %
Fe ₂ O ₃	07.64 %
Al ₂ O ₃ + TiO ₂	16.24 %
Alkalies (CaO, MgO, Na ₂ O, K ₂ O)	12.94 %
<u>Loss on ignition</u>	<u>06.60 %</u>
<u>Total</u>	<u>99.77 %</u>

Output (Products, byproducts with specifications)

Product: Lightweight Aggregate

- Density: 40 – 48 lb/ft³ (636 – 763 kg/m³)
- Compressive strength: 2700 PSI (28 days)
- Water of absorption: 5 %
- Size: 12.7 mm to 50 mm

Comparison of Structural Properties of Expanded Shale and Slate Concrete with Gravel Concrete.

Material	Average unit weight max LBS/CFT	Average 28 days Comp. Strength Minimum – PSI
Shale Concrete	88.10	2580
Slate Concrete	93.25	2700
Gravel	140.00	3125
ASTM Specification No. C-330-79	100.00	2500

Byproduct: Nil

Applications/Uses

- Bridges
- Runways
- Flyovers
- High rise buildings

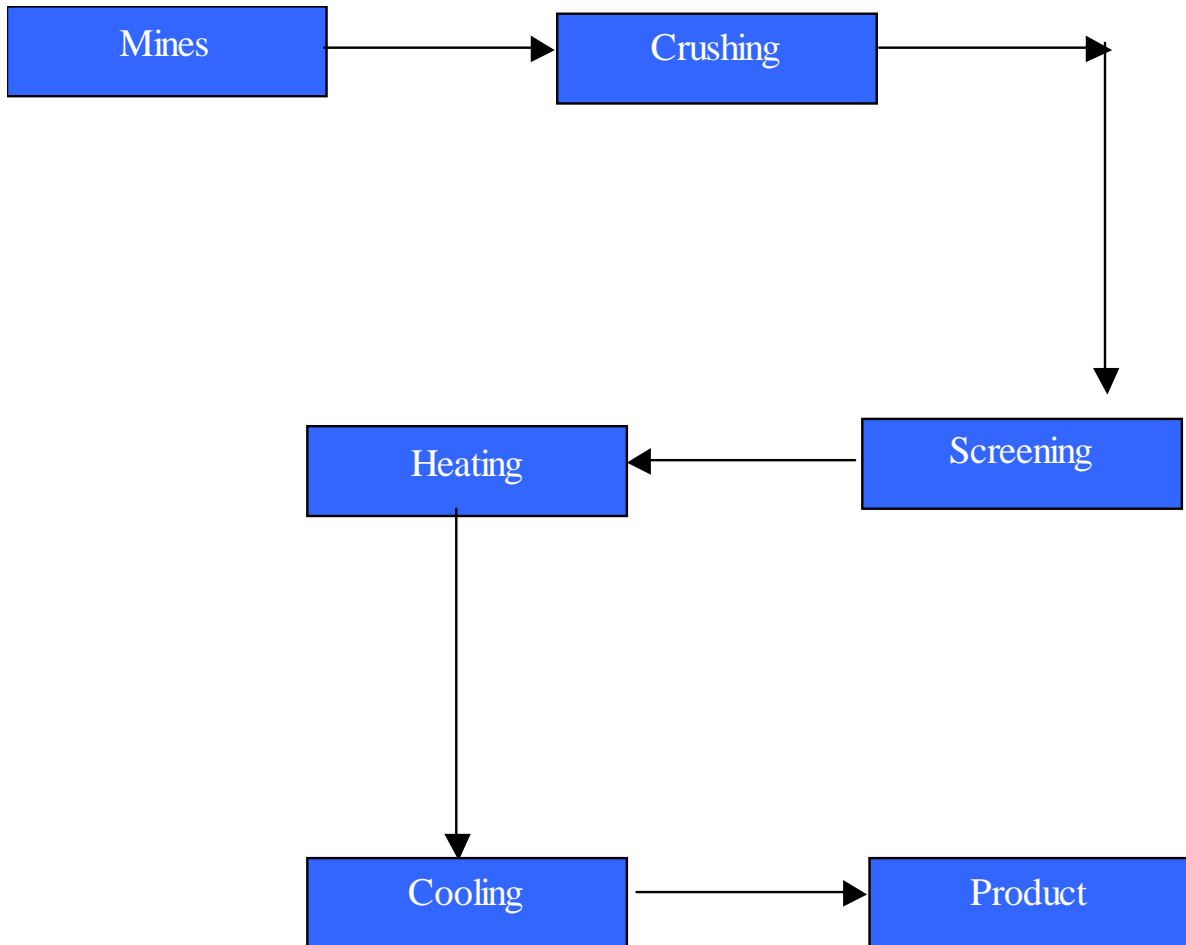
Trial Results:

Successful

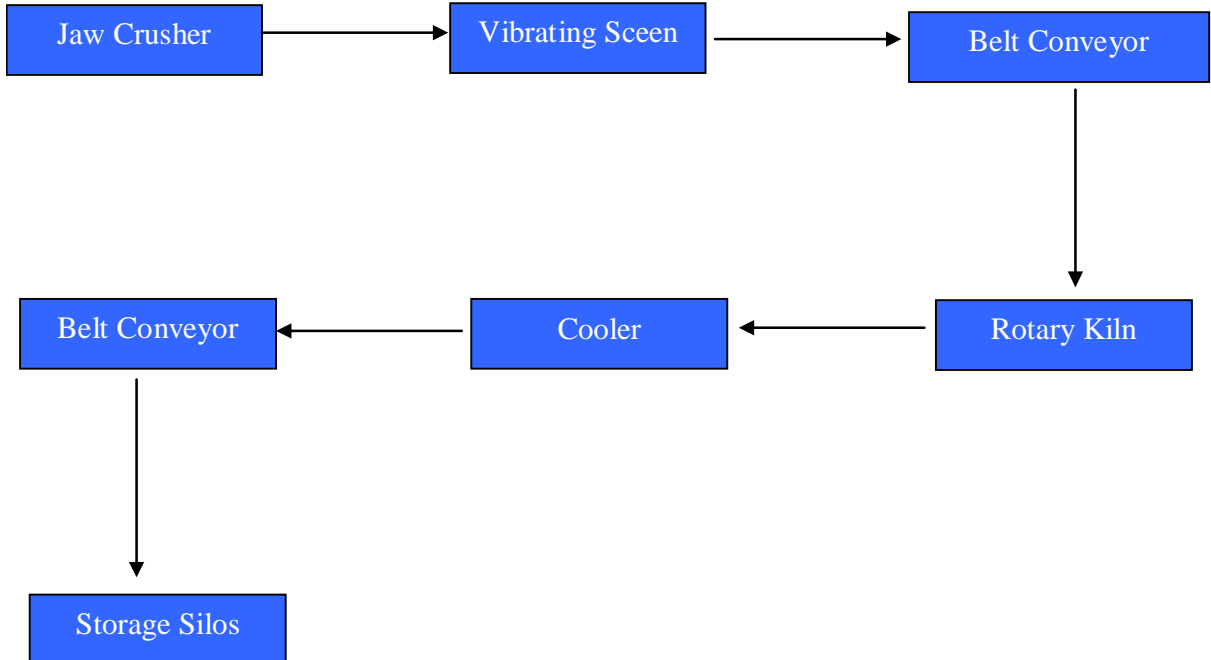
Technical Data (*Proposed capacity, Production time per batch, Packing size*):

- Proposed capacity: 12 ton/ day
- Production time per batch: 1 hr
- Packing size: Not required

Production Process/Flow diagram:



Equipment Layout diagram:



Machinery required with specifications:

S. No	Item	Description	Qty	Cost (Million Rs.)
1.	Jaw crusher	Capacity 500 kg/hr Feed size: 6-12 inch Product size: 0.5 to 1.5 inch	01	0.70
2.	Screen	Capacity 500 kg/hr Mesh ranges: 0.5,1,1.5,2 inch	01	0.75
3.	Rotary Kiln	<ul style="list-style-type: none"> • Length 30 ft, dia 4 ft • Motor: 20 hp • Blower (2 hp) • Feeding and product receiving by conveying system • Equipped with temperature control and flue gas recycling system 	01	7.06
4.	Cooler	Length: 10 ft Motor: 10 hp Cooling system: Air or equivalent		2.00
5.	Balance	Weighing range: 100 kg	01	0.01
5.	Miscellaneous items including office equipment, spares, accessories, and tools etc (@5%)			1.00
			Total	11.52

Standard specifications & test methods:

Standard specifications	Test methods
MgO , SiO ₂ . CaO, NaO etc	Standard Methods of Chemical Analysis by W.W SCOT and W. H FURMAN
Bulk density of aggregate	ASTM C -129, ASTM C-330 Significance of tests and properties of concrete Volume 1, by Josephf. Lamond, J. H. Pielert
Compressive strength	ASTM C-39/C-39M-05E2
Water of absorption	ASTM C-127

Quality control equipment with specifications:

S. No	Item	Quantity	Cost (Million Rs.)
1.	Density meter for aggregate materials	01	0.25
2.	Strength testing apparatus for concrete	01	0.40
3.	Thermal conductivity apparatus	01	0.40
5.	Specific gravity measurement apparatus	01	0.20
6.	Laboratory furnace (temperature upto 1400 °C)	01	0.50
7.	Digital balance (digital)	01	0.15
8.	Glassware and chemicals	-	0.10
9	pH meter (digital)	01	0.20
Workshop Item			
10	Transformer and generator	01 each	2.00
11	Lath Machine	01	0.40
12	Welding Plant	01	0.10
13	Cutting Machine (fixed and movable)	01 each	0.10
14	Drill Machine (fixed and movable)	01 each	0.20
Total			5.00

Environmental impact:

Environment Friendly

Availability of technical support:

Available

Availability of Brochures/Pamphlets:

Available

Status of registration/Patent/Trade Mark:

Nil

3. Estimation of Fixed Capital Investment (PKR)**Land:**

Rs. 4.00 million (0.25 acre @ Rs. 16.00 million per acre)

Building:

Rs. 10.00 million

Furniture and Fixture:

Rs. 0.25 million

Plant & Machinery:

Sr. No	Description	Cost (In million Rs)
1.	Machinery/Equipment	11.52
2.	Installation and Erection cost @ 6%	0.69
3.	Instrumentation and Control @ 5 %	0.57
4.	Services facilities including designing, consultancies etc @ 5 %	0.57
5.	Transformer, generator, quality control and mini workshop equipment	5.00
	Total	18.35

Technology Transfer Fee:

Rs. 5.00 million

Total Fixed Cost of the Project:

Sr. No	Description	Cost (In million Rs)
1.	Land	4.00
2.	Building	10.00
3.	Furniture and fittings	0.25
4.	Plant & Machinery	18.35
<i>Total Fixed cost of the Project</i>		32.60

Total Project Cost

Sr. No	Description	Cost (In million Rs)
1.	Total Fixed cost of the Project	32.60
2.	Working capital	6.20
<i>Total Project Cost</i>		38.80

4. Marketing Aspects:**Total industry and annual growth:**

Nil

Current demand:

Significant demand throughout the country

Local production facilities:

Nil

Imports:

Rs. 0.05 million per ton will be spent for import of lightweight aggregate

Major users:

Construction Industry

Marketing strategy:

- Supply of samples to SMEDA for marketing
- Distribution of brochures among stakeholders
- Display of the samples at various chambers of commerce and industry
- Publicity through electronic and print media
- Holding of seminars and exhibitions

5. Details of Cost:

Sr. No	Description	Cost (Rs)
1.	Direct Production Cost	6925/ton
2.	Raw materials cost per unit	3333/ton
3.	Direct wages cost per unit	Nil
4.	Production overheads cost per unit	275/ton
	Admin and selling expenses	117,500
5.	Salaries and benefits per month	300,000
6.	Utilities charges per month	650,000
7.	Communication expenses per month	5,000
8.	Other expenses per month (depreciation)	15,000
9.	Publicity, advertisement and packing expenses per month	150,000