



ASIA PACIFIC PARTNERSHIP OF CLEAN DEVELOPMENT & CLIMATE

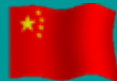
Management of Bauxite Residue (Red Mud)

Ministry of Mines, Government of India

&

JNARDDC & NALCO

**Presented by
Dr. Jyoti Mukhopadhyay**



The AP7 Partnership has established public-private Task Forces in eight key sectors:

- i. Cleaner fossil energy
- ii. Renewable energy and distributed generation
- iii. Power generation and transmission
- iv. Steel
- v. Aluminium
- vi. Cement
- vii. Coal mining and
- viii. Buildings and Appliances





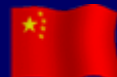
ALUMINIUM TASKFORCE

ASIA PACIFIC PARTNERSHIP OF CLEAN DEVELOPMENT & CLIMATE

19 – 21 April 2006, Berkeley, California

The ATF has agreed on seven project proposals:

1. Aluminium Measuring and benchmarking (US)
2. Management of PFC Emissions (US)
3. Management of bauxite residue (Red Mud) (Australia)
4. High Silica Bauxite Processing (China)
5. Fluoride Emission Management (US)
6. Aluminium Recycling (US)
7. Linkages to Technology Providers (US)



Highlights of 3rd Aluminium Task Force Meeting of 20th November, 2007 at Hyderabad , India

Dr.Raj Rajakumar reiterated that the Indian Ministry of Mines had appointed Director, JNARDDC, Dr. J Mukhpodhyay as the nodal officer for coordinating the project on “Management of Bauxite Residue” by AP-7 partnership’

Dr. J Mukhpodhyay along with the representatives of NALCO presented the proposed activities to be carried out in the Indian context.

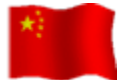
Fourteen specific areas were identified for the bulk utilization of red mud. Dr. Chris Vernon and Dr.Raj Rajakumar of CSIRO appreciated the Indian effort in the utilization of red mud.

Being the project leader of Bauxite Residue management project, they suggested to focus on the most promising Areas of bulk utilization with cross sectorial application with cement and steel industry.



Highlights of 4th Aluminium Task Force Meeting of 14th May, 2008 at Cape Town , South Africa

Representatives from Ministry of Mines and NALCO attended the Cape Town meeting. Dr. Raj Rajakumar of CSIRO presented Indian contribution on behalf of Dr. J. Mukhopadhyay and NALCO. He indicated that Indian sub-projects are (1) Development of Stabilized Blocks (2) Bench scale studies for Glass Ceramics (3) Development of Light Weight Aggregates Foam Products and (4) Use of Red Mud for Soil Amendments.



Project Objectives

Improve Storage practices of Red Mud

Developing residue treatment and chemistry to improve storage stability.

These include effective removal/ neutralization of the alkalinity to reduce the environmental impact on the possible ground water contamination.

Identify Large Volume, low cost, comprehensive re-use options

A comprehensive residue reuse options giving large volume usages with low cost and good public acceptance .

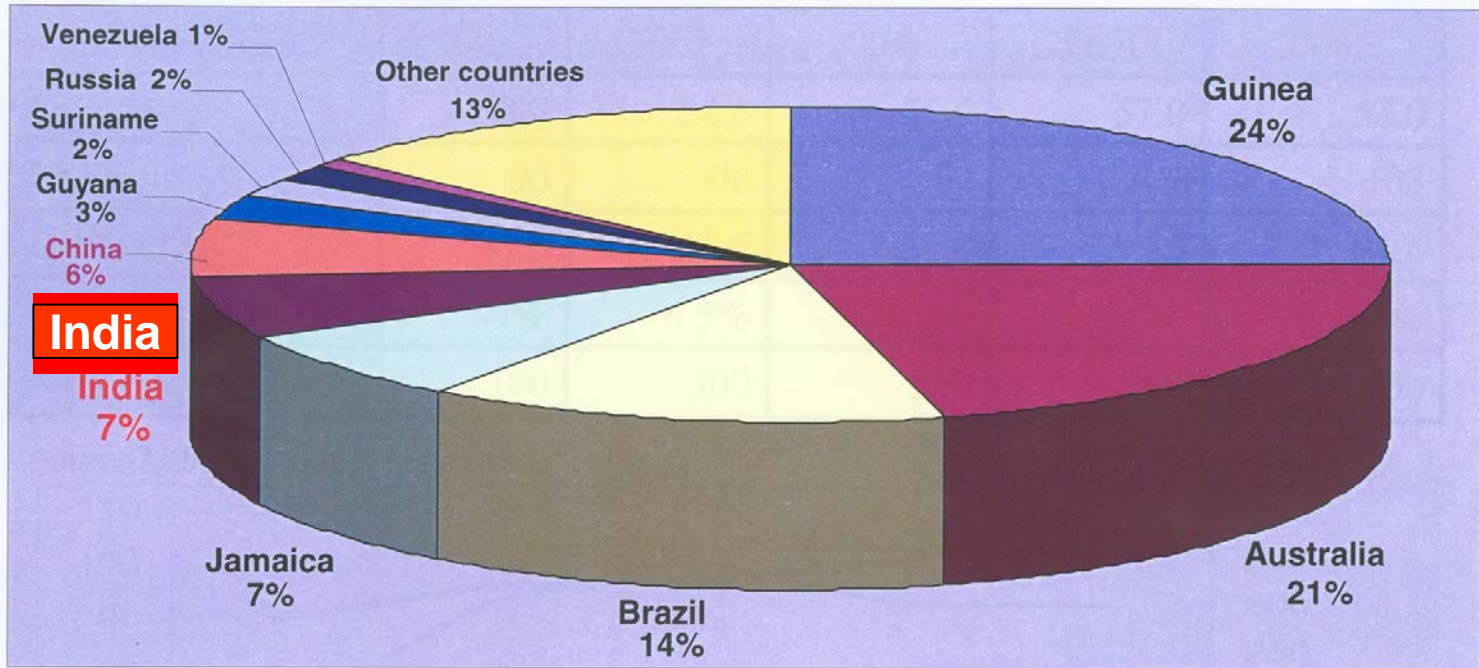
Establish knowledge sharing mechanisms to gain from AP7 initiatives

An extranet site to all the participating countries will be developed in order to provide all shared informations concerning bauxite residue, storage practices, environmental impacts and residue reuse opportunities. The research providers will be expected to participate annual bauxite residue workshop across the participating countries.





World Bauxite Reserves



India: Total Reserves * (proved + probable + possible) - 3037 Million Tonnes
Recoverable - 2525 Million Tonnes
Proved & probable - 1218 Million Tonnes

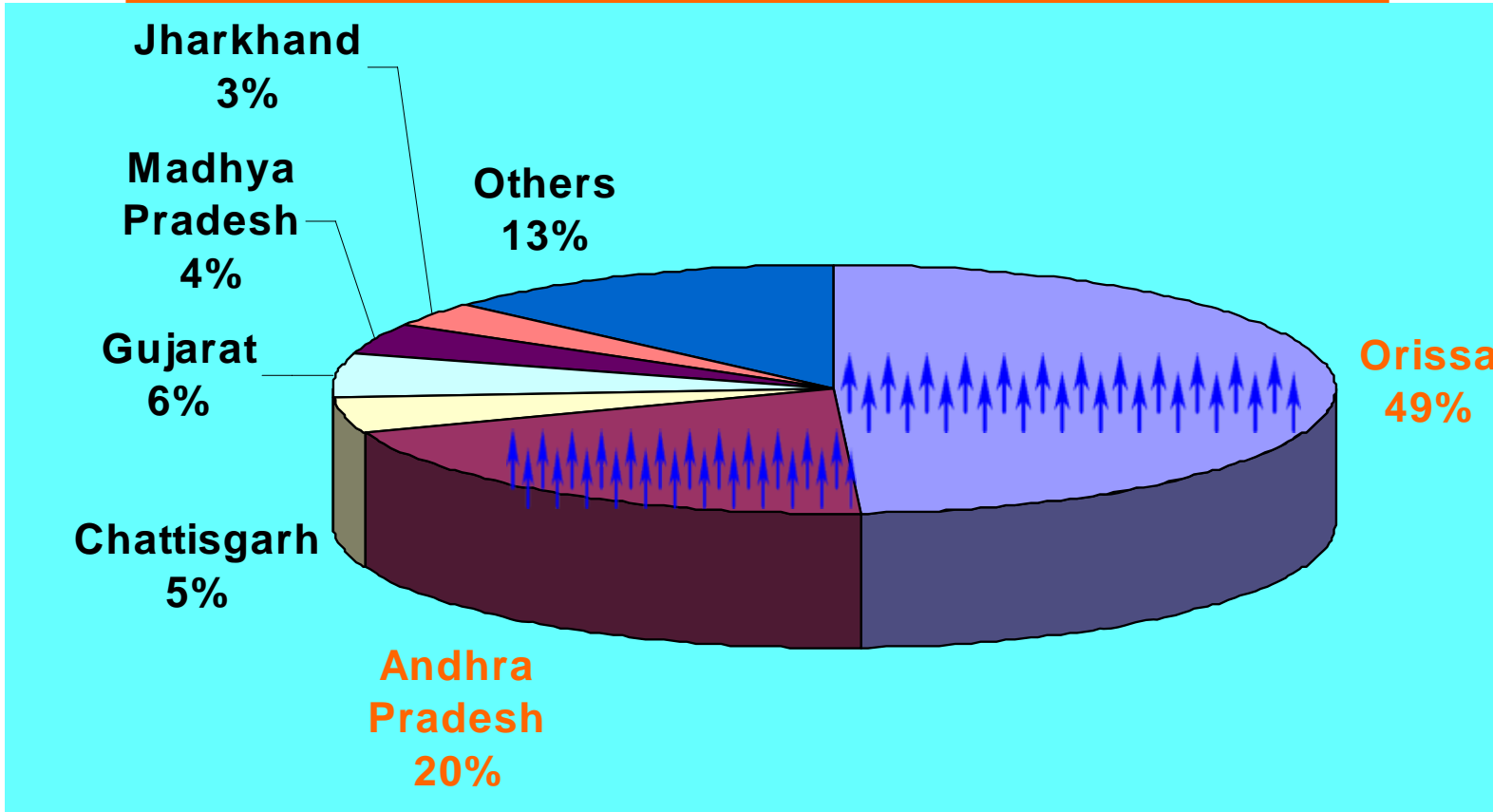
Rank:

5th in World



Indian Bauxite Reserves

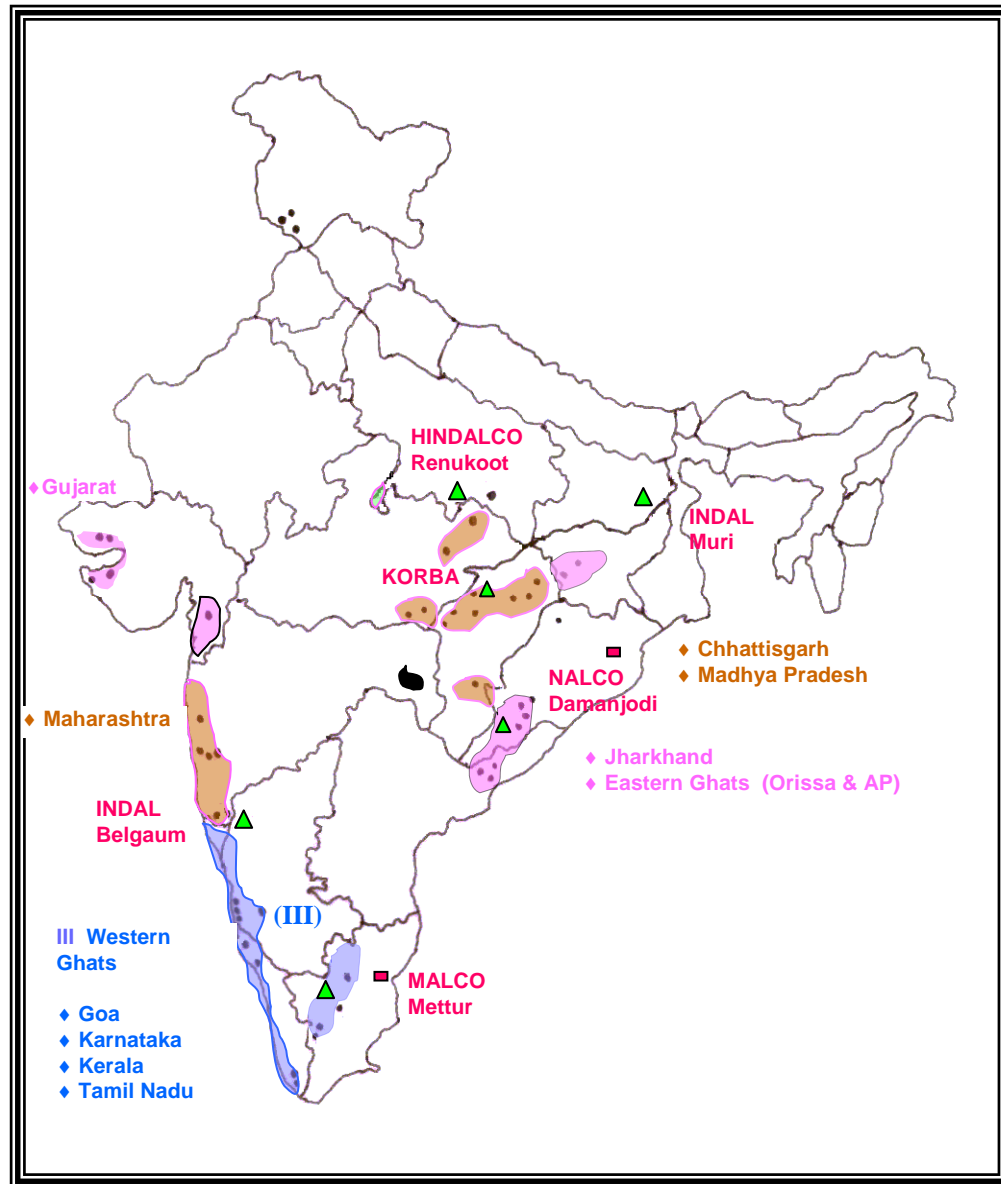
(As on 1.4.2000)



Orissa	AP	Chattisgarh	Gujarat	MP	Jharkhand	Others	Total
1491	613	137	179	122	102	394	3037

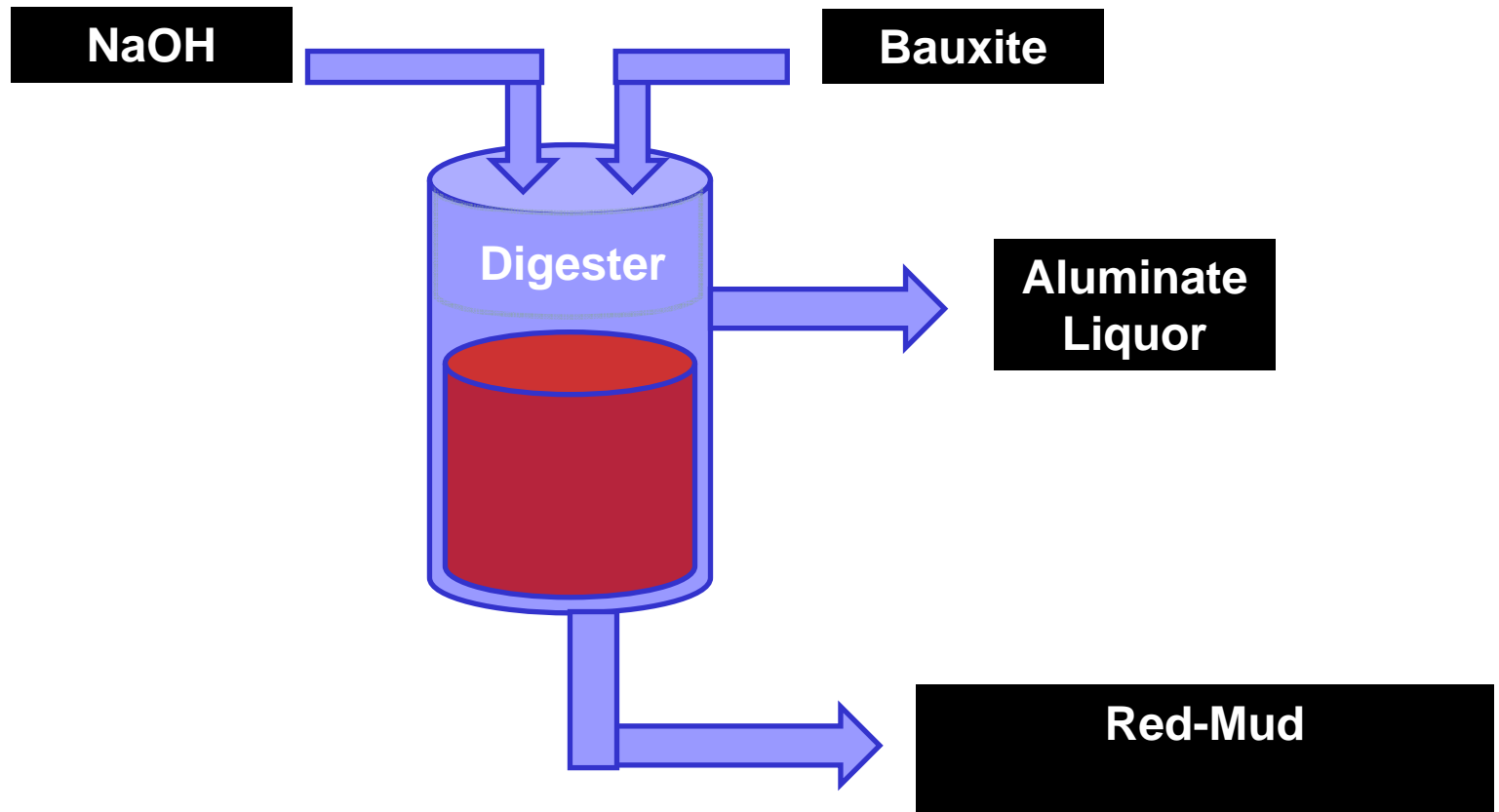
In million tonnes

Indian Bauxite Deposits

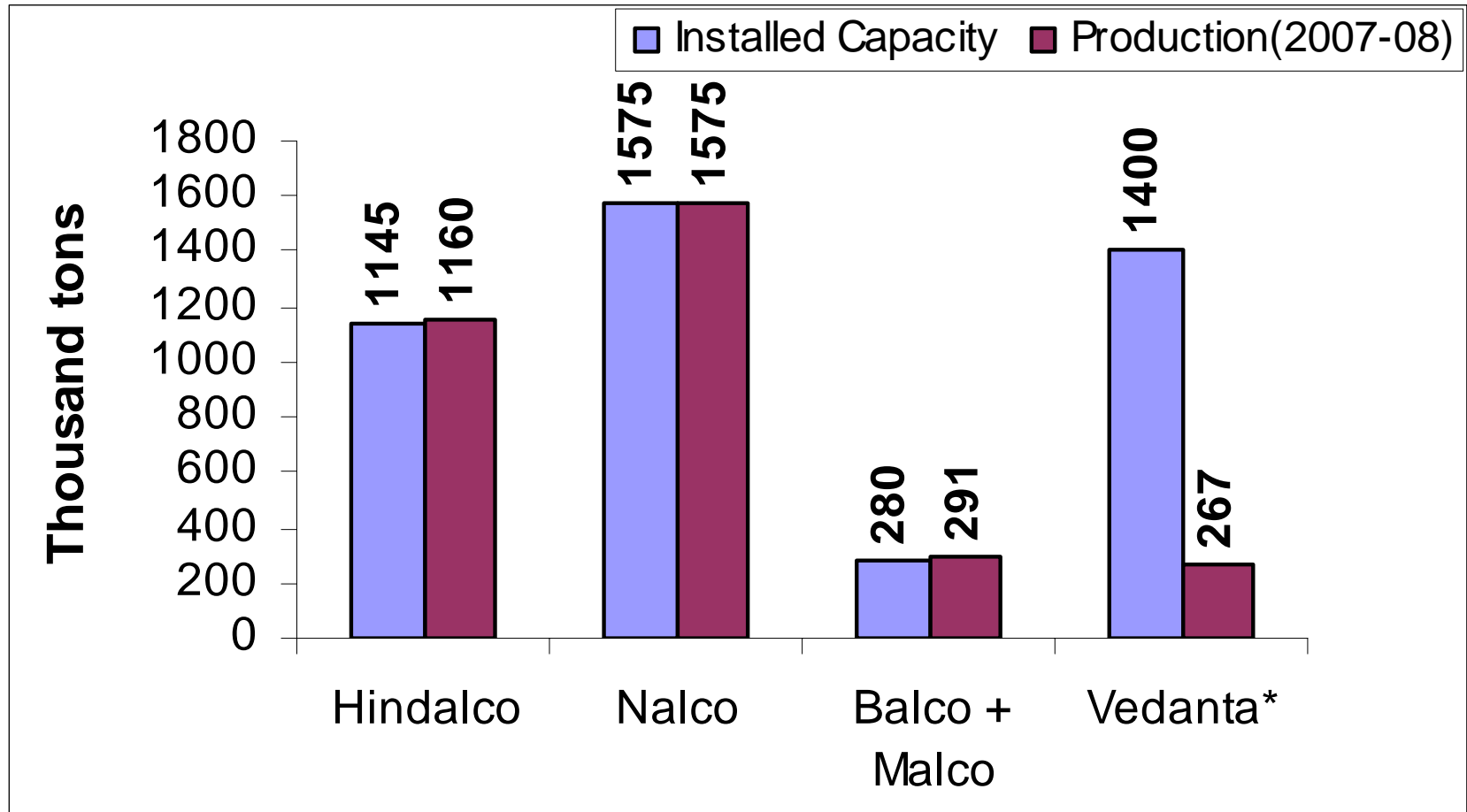


Conventional Bayer Process

Alumina Production (Al_2O_3),

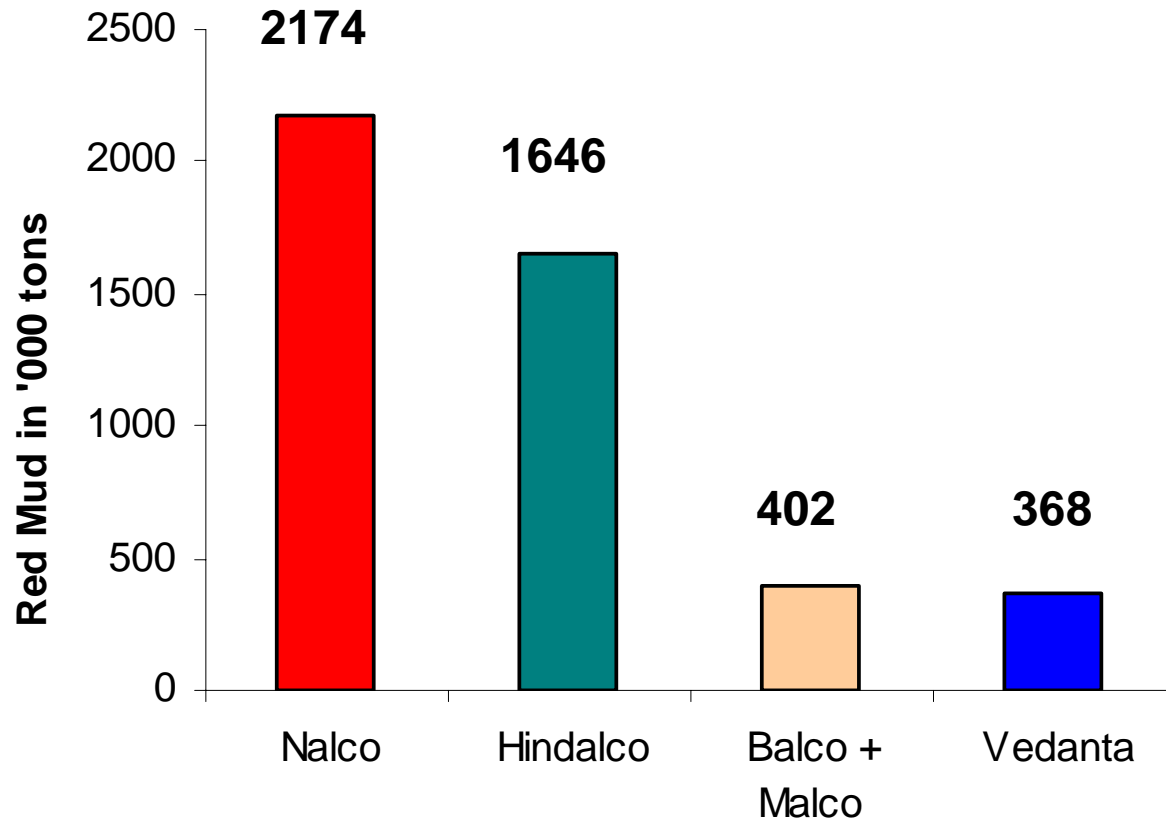


Alumina Production in India



Total Production for 2007-08 ('000 tons) 3326

Red Mud Generation in Indian Alumina Plants



Total Red Mud Generation for 2007-08 ('000 tons) 4590



Red Mud Generation

- Approximately 1.2 –1.5 ton of red mud is generated per ton of alumina production

World Production (75 mt/annum)

India 4.6



World 70.4

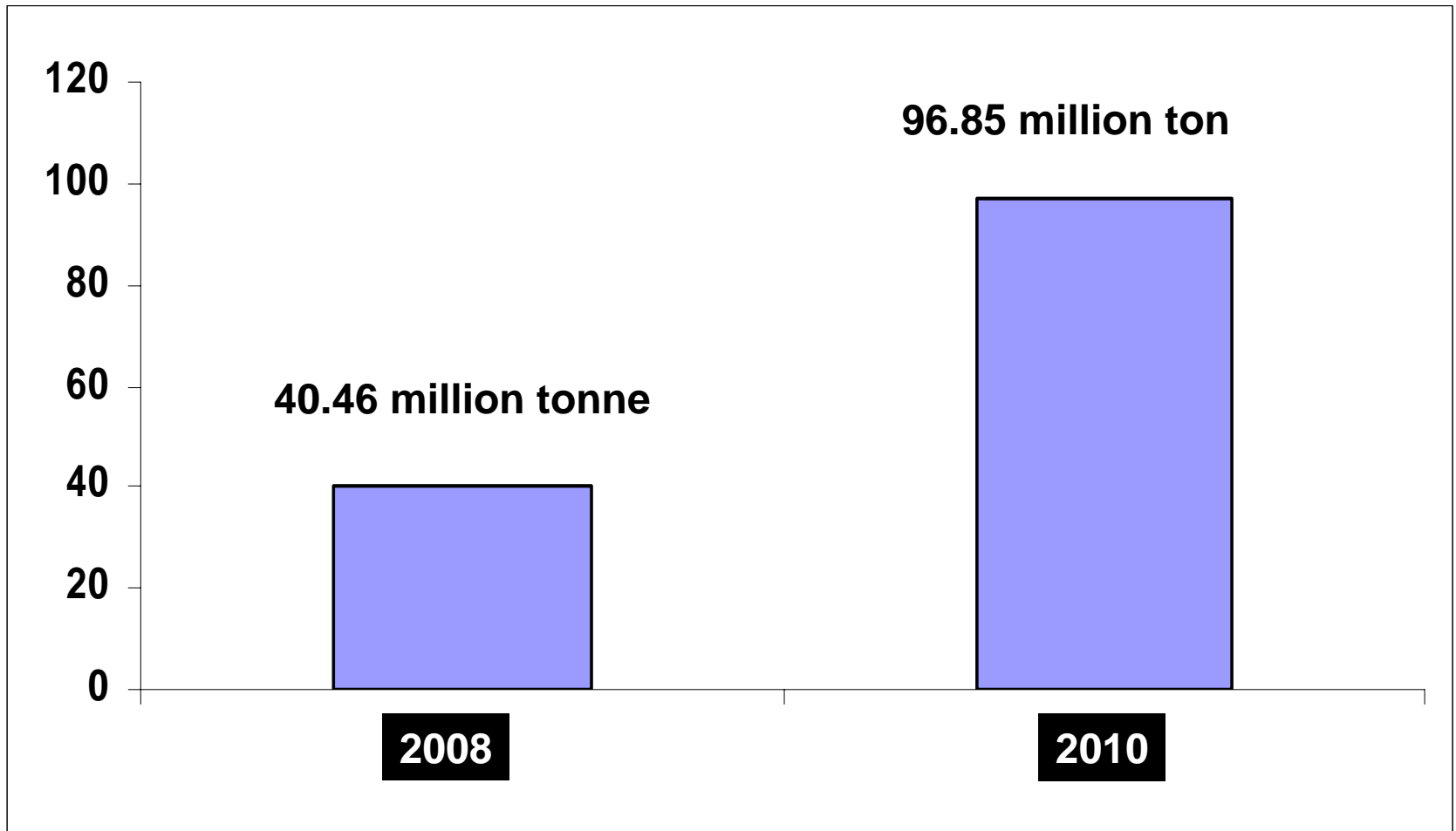


Present and Future generation of Red Mud in India

RED MUD GENERATION IN INDIA – Present & Projections			
Company	(i)Present generation (Lakhs Ton/Annum)	Company	(ii) Addl.Gen. by 2010 (Lakhs Ton/Annum)
NALCO	20.47	NALCO	6.50
HINDALCO	16.07	HINDALCO	4.55
BALCO	2.97	VEDANTA	18.20
MALCO	0.95	UTKAL	19.50
TOTAL	40.46	RAYKAL	18.20
		ADITYA	18.20
		JSW	18.20
		TOTAL	96.85
Grand Total -(i) + (ii)			137.31



Red Mud Generation in India: Present and Future Alumina Plants



Indian Red Mud - Characterisation



East Coast

Central India

High Fe & Low Ti

18-20	Al_2O_3	17-20
50-55	Fe_2O_3	33-37
4-5	TiO_2	17-20
5-6	SiO_2	7-9
4.5-6	Na_2O	5-6
0.1-0.6	CaO	0.5-2
11-12	LOI	8-10

Low Fe & High Ti



Research Activities proposed to be taken up under AP-7 Project on Management of Bauxite Residue

Activity	Red mud use	Application
Development of Stabilized Blocks	20-45 %	Road, Sea/river shores, house floors, railways
Bench Scale Studies for Development of Glass Ceramics	15-25 %	Decorative tiles for household and buildings
Development of Light Weight Aggregates- Foam Products	10-15 %	Building construction, Security walls
Use of Red Mud as Soil Amendments	10-20 %	Converting arid lands to fertile lands – Assistance to be taken from Australia.



Development of Stabilized Blocks

Brief Description :

1. Produced by mixing red mud with fly ash and Portland cement (or lime grit).
1. This exhibit a dry compressive strength of 80 kg/cm²
2. Preliminary studies in India have shown promising results
3. It will consume considerable quantities of both solid wastes (Red mud + Fly ash) simultaneously.
4. This stabilized blocks are basically non-fired blocks.
5. For requirements of higher strength, other additives will be used.

Application :

1. Controlling sand erosion near sea/ river shores.
2. Construction uses in Railways.
3. Pavement on the village roads.
4. Flooring in single storey buildings and many other applications in rural areas.
5. Small size blocks for building walls, compound walls etc

Current Status:

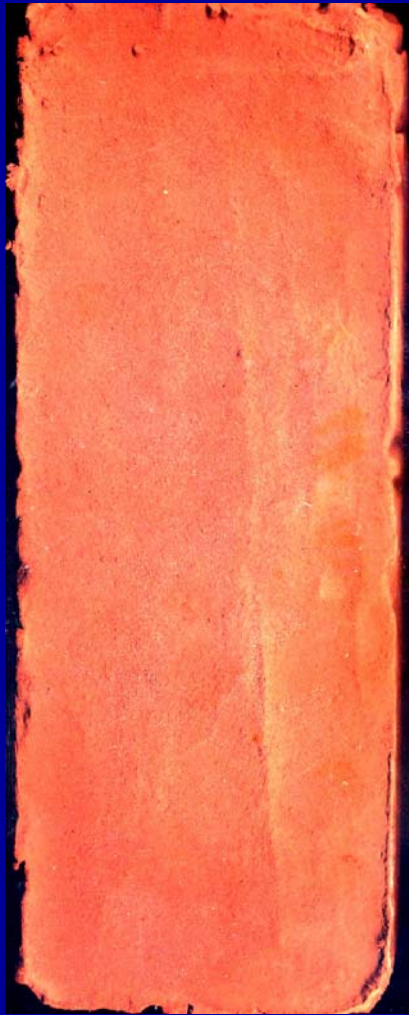
1. No major use has been reported in India.
2. Some applications have been reported in foreign countries for controlling soil erosion in sea shores.

This needs to be taken up in a systematic manner for its high volume utilization.

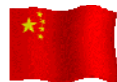
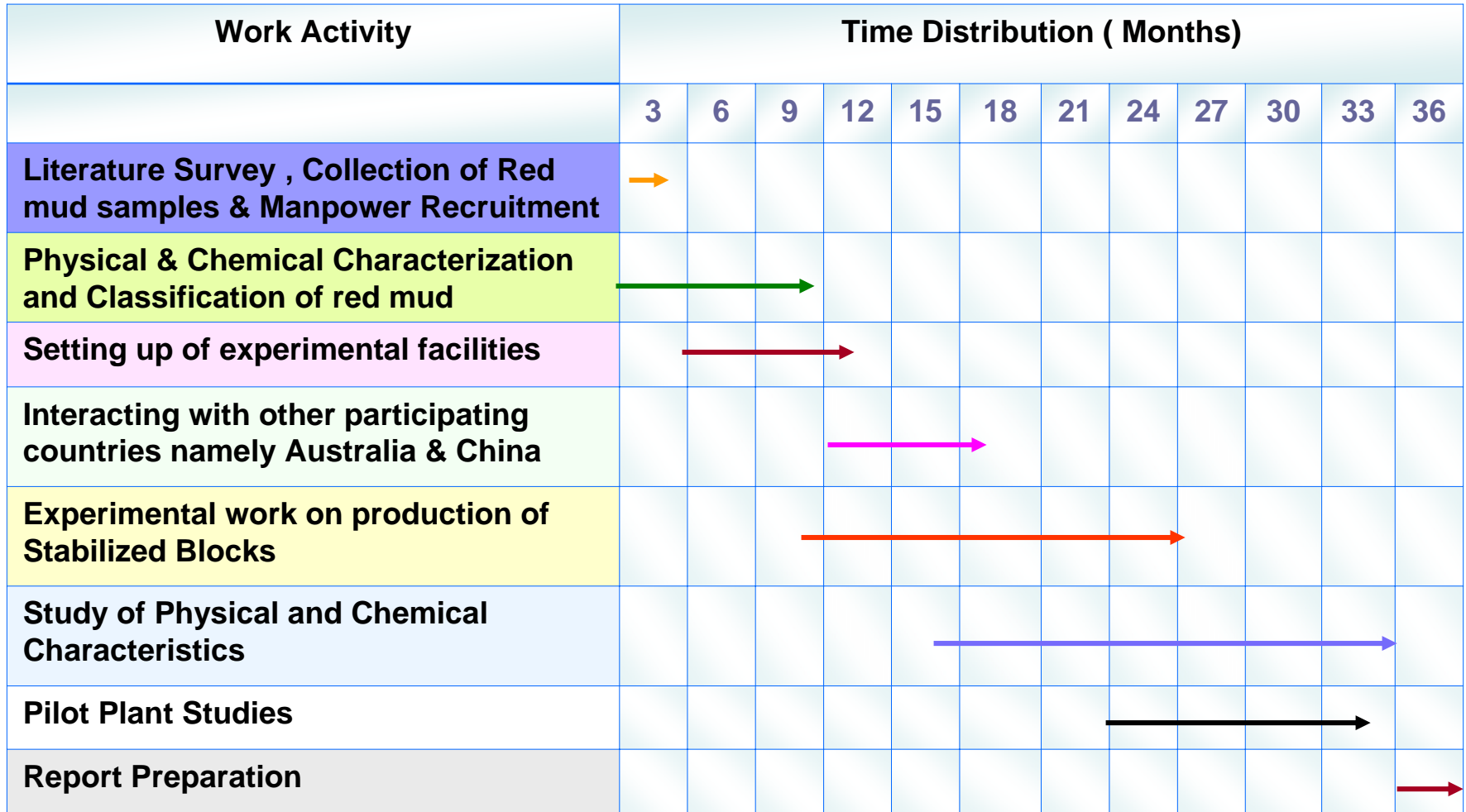
Time Frame for Bench Scale Studies

: 3 Years

Development of Stabilized Blocks



Bar Chart : Development of Stabilized Blocks



Bench Scale Studies for Development of Glass Ceramics

Brief Description :

1. JNARDDC has carried out laboratory studies
2. Admixture of red mud, fly ash and glass forming substance
3. Excellent glossy finish, good mechanical strength and abrasion resistance.
4. The colour obtained can be varied by modifying composition or adding coloring agents.
5. Bench scale trials are needed to work out the techno-economics of the process.
6. Pilot plant for demonstration of the process for its commercialization.

Application :

1. Cost effective substitute for granite and decorative vitrified tiles on the walls and floors.
2. By modifying the composition, hard and varied texture of tiles can be prepared.

Current Status :

1. Laboratory study reveals technical feasibility.

This needs to be followed up with extensive studies, scaling up and optimization.

Time Frame for Bench Scale studies : 3 Years

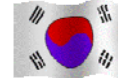
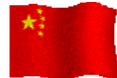
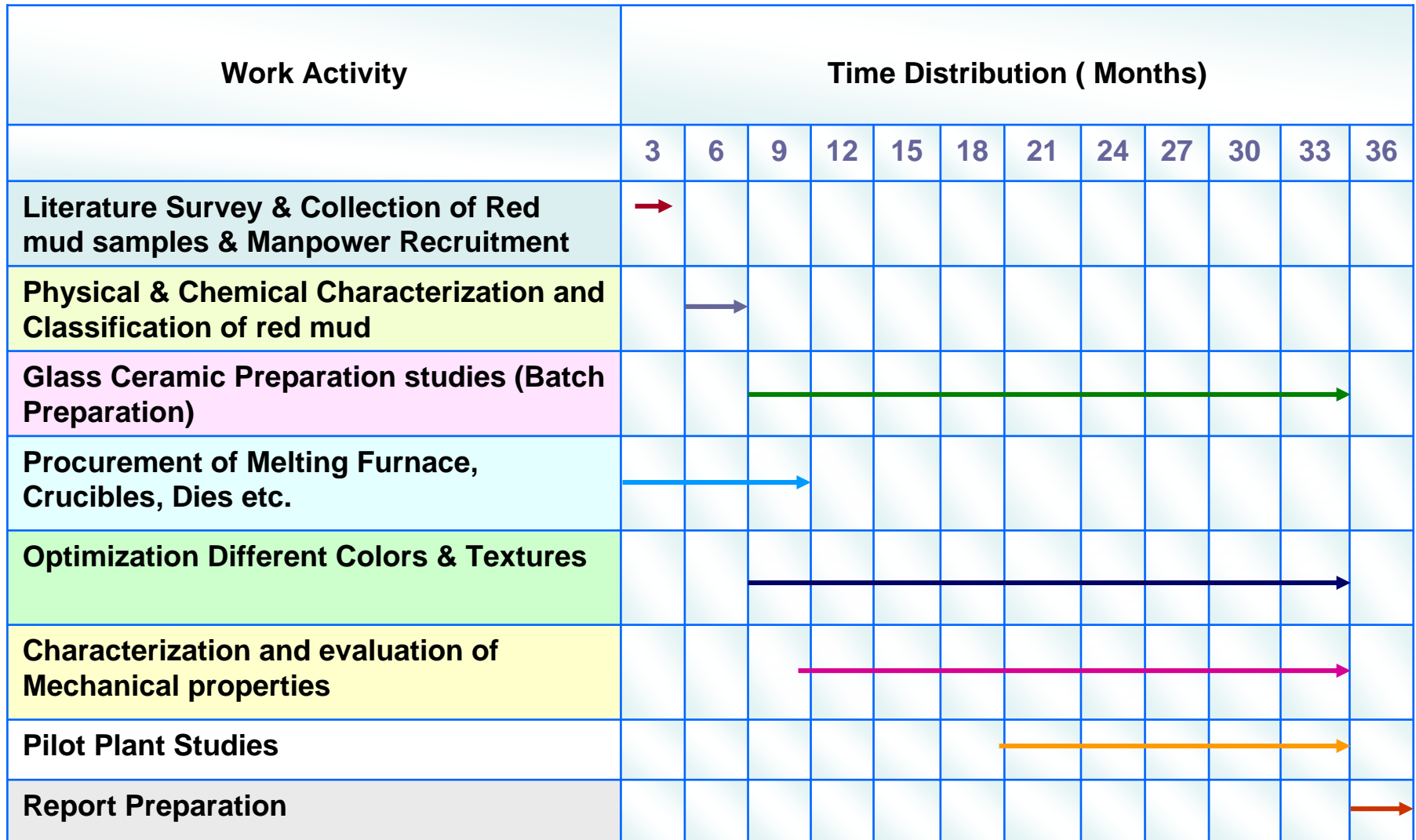
Properties of Developed & Commercial Ceramic Tiles

Comparative Data on Properties on Red mud and Ceramics Tiles			
Mating surface	SiC paper # C – 1000		
Track length	20 cm		
Specific Wear Rate kg/m ² at			
Sample different load	0.2 kg	0.45 kg	0.65 kg
Red mud tile 1	8.0×10^{-4}	8.2×10^{-4}	9.4×10^{-4}
Red mud tile 2	6.6×10^{-4}	7.5×10^{-4}	7.6×10^{-4}
Ceramic tile (commercial)	9.9×10^{-4}	12.5×10^{-4}	13.5×10^{-4}

Glass Ceramic Tiles from Red Mud



Bar Chart : Development of Glass Ceramic Tiles



Development of Light Weight Aggregates Foam Products

Brief Description:

From some preliminary work carried out elsewhere, it has been found that, red mud with certain additives when fired at 1000°C exhibits a crushing strength of 130-160 kg/cm².

Application :

1. Multistoried building construction
2. Will lead to substantial reduction in the total weight of walls and partitions in multi storied buildings; thus reducing the foundation costs and total building cost.
3. Production of Thermal insulation & Impact Resistance Materials

Current Status :

Not much studies have been carried out. Research work to be carried out from Lab. scale to Bench scale.

Time Frame for Bench Scale studies : 3 Years



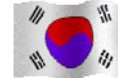
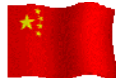
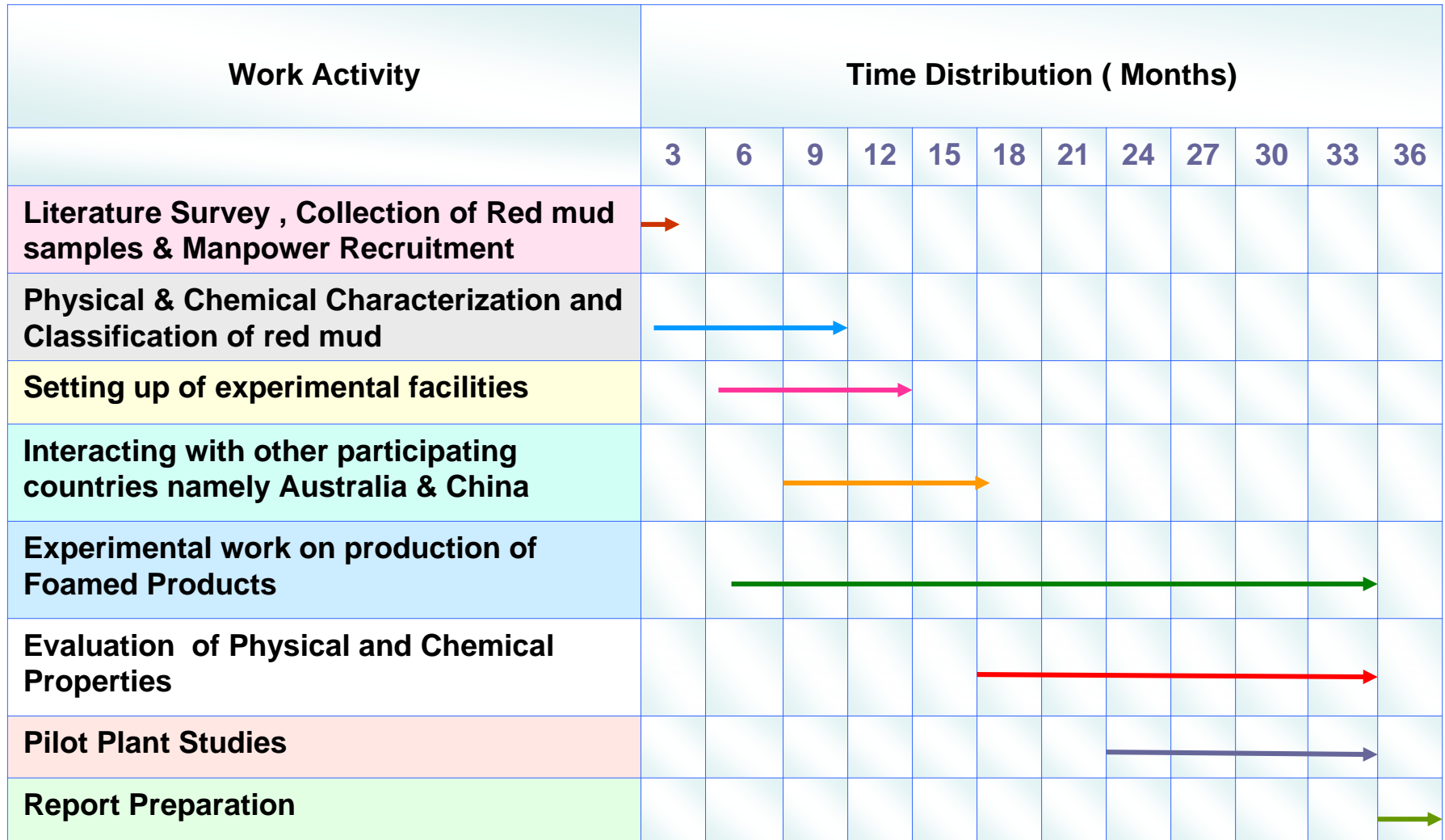
Development of Light Weight Aggregates Foam Products



Development of Light Weight Aggregates Foam Products



Development of Light Weight Aggregates Foam Products



Use of Red Mud as Soil Amendments

Brief Description :

This application has reported to improve water retention by 50 %, reduced the loss of nutrients (especially Phosphorus & Nitrogen) and provide several bases and micronutrients).

Application :

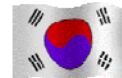
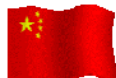
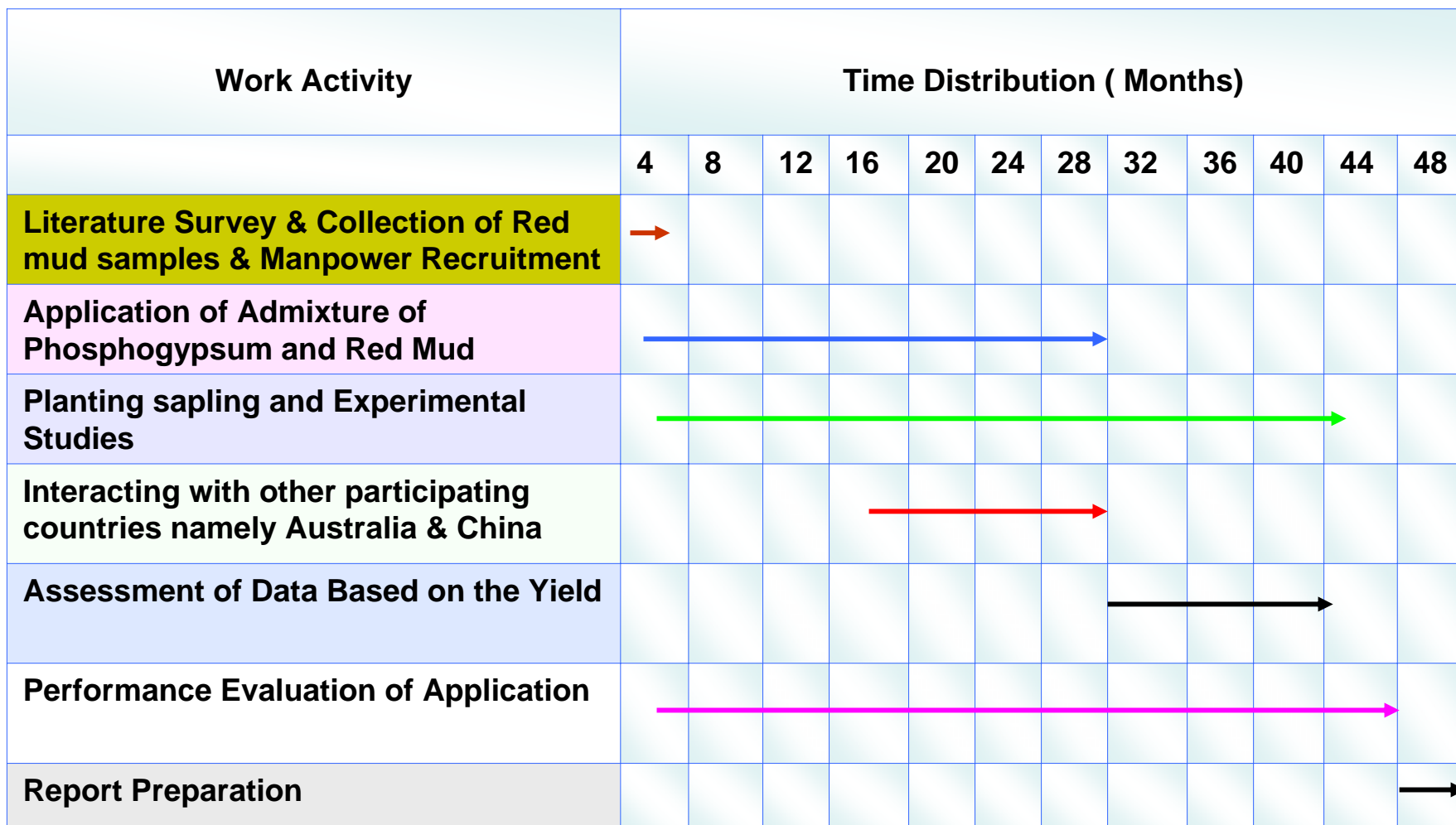
1. Soil amendment improves soil productivity by converting sandy soils with low water retention and providing micro-nutrients for increasing crop yield.
2. Such application is quite useful to convert arid lands to useful land for growth of trees.

Current Status :

1. No studies has been carried out in India for tree plantation with wood value.
2. However, extensive studies have been carried out at Australia.

Time Frame for Bench Scale studies : 4 Years

Bar Chart : Use of Red Mud as Soil Amendments





Thank you All[♥]

