11TH GEOPOLYMER CAMP – 10 JULY 2019

RED MUD – FLY ASH [RFFG] GEOPOLYCRETE ROAD TRIALS

R V RAMANI

KIRAN GLOBAL

- 2nd largest in Silicates;
- operational in 7 countries;
- largest supplier of Tunnel backfill grouts
- Captive Quartz & Feldspar mines; GGBS grinding facility
- Provides FREE supply of silicate binder for research work undertaken by institutes

ARGUS CONCRETE

- 2nd largest in active Geopolymer projects
- operational in 4 countries
- consuming average 40 tons of silicate binder everyday
- Heading the standards committee (BIS)

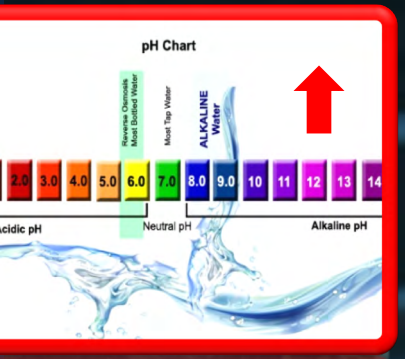
UNUTILISED
MINERAL
WASTE
70 (750) MTPA

noranda bauxite &alumina
ADITYA BIRLA
HINDALCO
AUSTRALIA
CHINA
BRAZIL
INDIA
USA
balco
vedanta
20,000 TPD
NALCO

Red Mud Disposal now...

- contain substantially elevated levels of several trace and toxic metals including iron, manganese, copper, zinc, cadmium, lead, chromium, arsenic & nickel

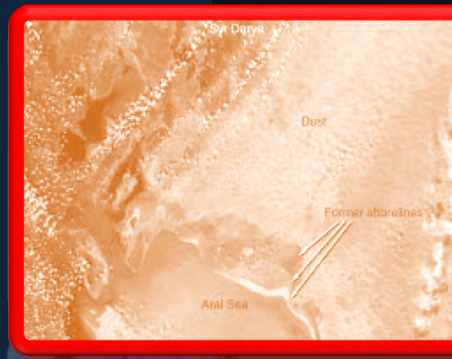
  make it difficult to safely dispose of and treat RM.
- Limited Safe & Economical large-scale application
- Currently disposed of into on-site waste lakes for further dewatering, consolidation and storage
- very costly due to mandatory environmental monitoring and long-term maintenance
- RED MUD IS A COMPLEX MATERIAL



HIGH pH

LARGE STORAGE

ALKALI LEACH



AIRBORNE DUST

RED MUD ISSUES

HIGH IRON

Red Mud Typical Analysis…

	TYPICAL	HINDALCO	NORANDA
$Fe_2 O_3$	35 – 50 %	63.3 %	42 – 44 %
$Al_2 O_3$	8 – 14 %	13.7 %	11 – 19 %
$Si O_2$		5.26 %	8 – 16 %
$Na_2 O$		2.84 %	5 – 8 %
Ca O		1.14 %	1 – 12 %
$Ti O_2$	4 – 10 %	4.13 %	4 – 9 %
LOI	5 – 10 %	7.72 %	5 – 8 %
Moisture	35 – 52 %		36 – 40%

Maghenite
Hematite
Goethite

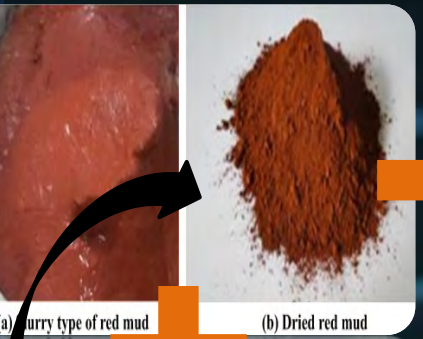
Geopolycrete

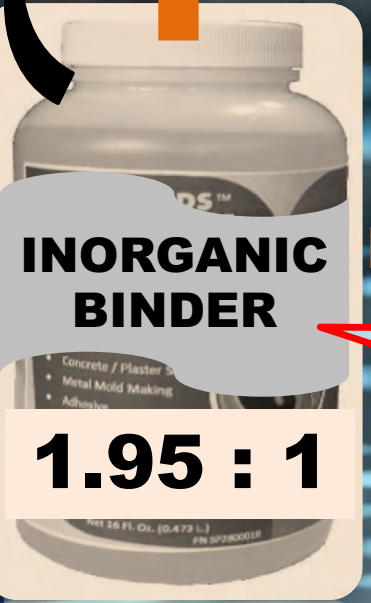
BINDALLINO

INORGANIC BINDER

BLEND OF SILICATES + POWDER + CATALYST

USER FRIENDLY





C ALYST

Silicates of Sodium, Feldspar, Pottasium, Humate, Liquid silica

GGBS, Microfine GGBS, Fly ash, PFA, Activated clay

BLENDING

- STONE

RM POND

PREPARING SITE

AD TRIALS

Redmud concrete Videos

Redmud concrete Videos

Redmud concrete Videos

Redmud concrete Videos

Redmud concrete Videos

COASTAL PROTECTION PRODUCTS

RMFA – STONE PILOT PLANT

- ROBOTIC SHOTCRETING with mobile app
- SENSORS IN MARINE GEOCRETE ARMOUR
- 2 AXIS PROGRAAMMABLE CONCRETE POURING SYSTEM

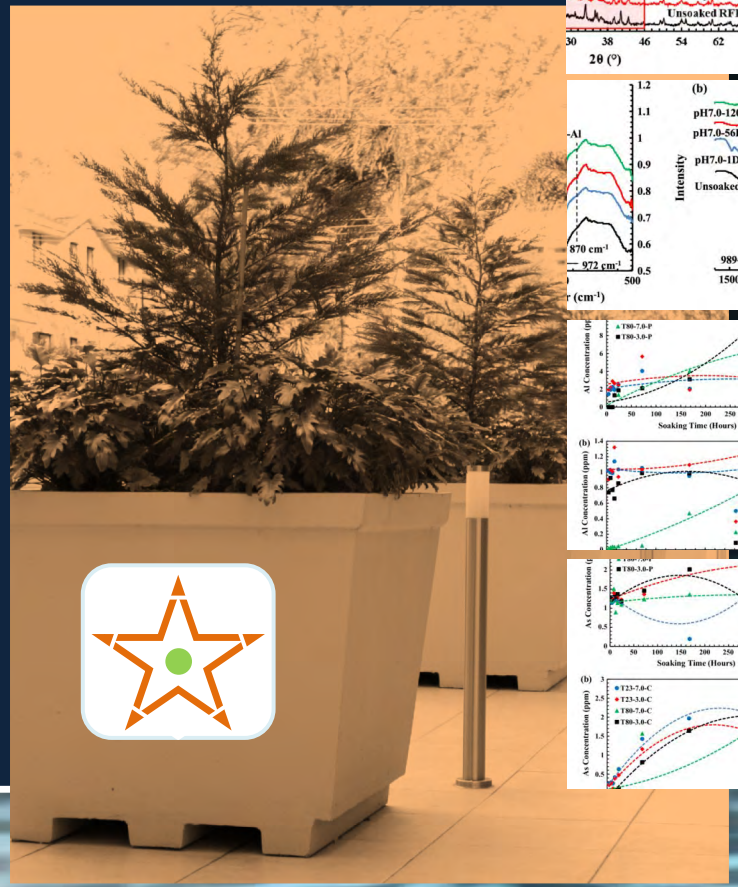
20%

TCLP Average Findings

- The concentrations of As, Cu, Cr and Cd detected in the leachate of the RFFG samples were all much lower than the respective contamination limits in soils set by the US EPA standard, even for the leachate of the powder RFFG samples. (FITR)
- The maximum contamination limits in soils set by US EPA are, in ppm

	Cu	Cr	Cd	As
ppm	45	212	2	5.6
<	0.15	0.15	0.15	2.0

- Furthermore, the use of RFFG in civil engineering projects that may be exposed to a sulfuric acidic environment will not introduce heavy metals at a level exceeding the respective EPA limits to the surrounding soils.



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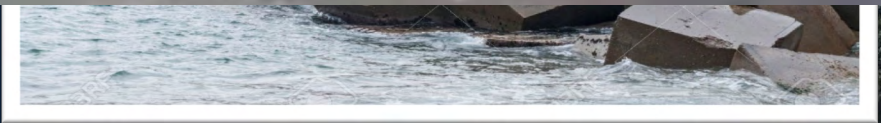
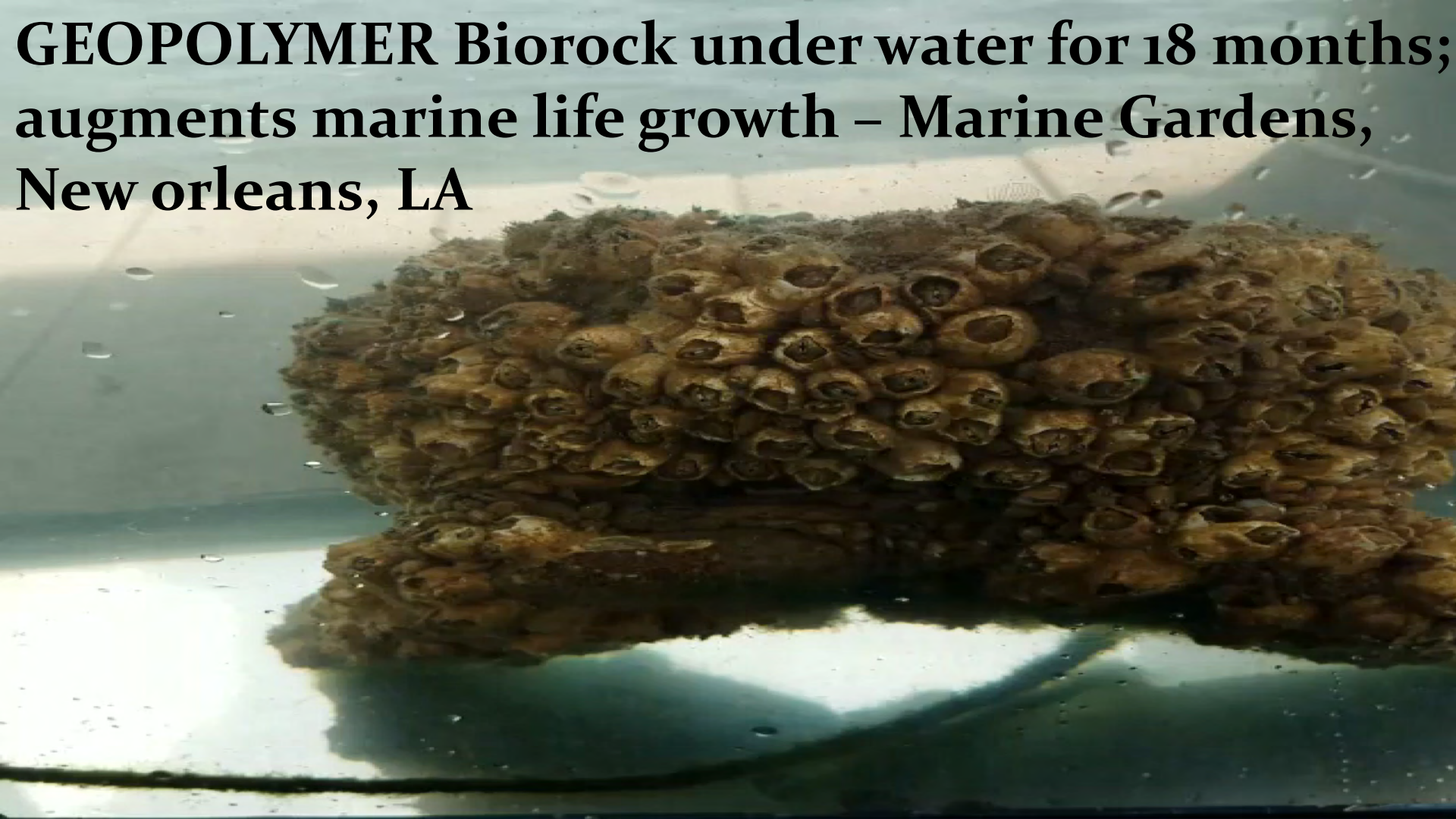


GEOPOLYMER Biorock under water for 18 months; augments marine life growth – Marine Gardens, New orleans, LA



FENCING SYSTEMS

Toxic & Radioactive Catalytic Waste Management

SPOT CRETE-XT XTRA

ALL PURPOSE

INSTANT GREEN CONCRETE

any time. any where.

FIRST TO EMERGE IN INDIA

DIY KIT

CLINKER FREE

SETS in 30 minutes

NO WATER NEEDED

MIX & FIX

Channel Partners

- Marine Gardens, USA
- Kamachi Steels Ltd, India
- ASTA Constructions, India
- I C C Ltd, Srilanka
- QGC International, Kuwait
- PT SMEC Denka Indonesia
- Alcon Group, India
- Pacifique Environment, New Caledonia
- GULF Minerals, Oman

CONCLUSIONS

- Therefore, **red mud-fly ash** based geopolymerization technology not only produces a more economical and **'greener' alternative to OPC**, but also lends itself to recycle and reuse two abundant industrial wastes: red mud and fly ash.
- The process of geopolymerization was confirmed by the composition of the final products analyzed by X-ray diffraction.
- The findings suggest that the two major industrial wastes, red mud and fly ash, can be **reused to produce geopolymers** that would hence be applied in civil infrastructure construction.

ARGUS

CONCRETE SOLUTIONS

INDIA – USA - SINGAPORE

THANK YOU

Geopolycrete Applications

- Coastal armor
- Concrete Roads
- Heavy Foundations
- Canal bank / River bed
- Shotcreting
- Precast products
- HM Waste containment
- Container Home

COMPARISON

M30	G P C / cu.m		
TANGIBLE	Curing water	150 lt	
	Disposal of R M	180 kg	
	Land reclaim	0.7 sqm	
	C S R/ TeNORM	✓	

M35	RFFG / cu.m		
INTANGIBLE	CO2 emission	700 lb	min
	Labour reduction	25%	min
	Landfill reduction (mining + fill)	8cft	min
	Sustainability	⏭	🪴

	How utilised		Observations
1.	LAGOONING (WET POND)	1500 T/ ACRE	VAST LAND AREA
2.	D		DLING
3.			ncrete
4.			vement
5.			e
6.			lity
7.	S		cost
8.	METAL RECOVERY		Very low ROI
9.	NEUTRALISATION		High processing cost
10.	GEOPOLYCRETE	> 50%	Technology access

TECHNOLOGY & ECONOMY

DISPOSAL & ENVIRONMENT

UTILISATION & PROCESSING

Red mud Advantages ...

- alkaline content
- Si & Al - potential source material
- Reduction in alkali hydroxide
- industrial waste
- low carbon footprint - sustainable
- High iron content binds well
- For better strength & desirable setting time Red Mud & Fly Ash to be ground to > 45µ
- Natural colourant