

## EXPERIMENTAL INVESTIGATION OF PROPERTIES OF PASSIVE MATERIALS FOR THE FORMATION OF BRICK

Mr.V.MURUGESH

Assistant Professor, JCT College of Engineering and Technology, Coimbatore.

SNEHA N,

Student ,JCT College of Engineering and technology

**Abstract** - A Brick is a building material used to make walls, and other element in masonry construction. Traditionally the term brick refer to a unit composed of clay but it is now used to denote rectangular unit made of clay bearing soil {Red soil}, sand and lime or concrete material. Bricks are produced in numerous classes, type, material and size which vary with region and time period and are produced in bulk quantity. Brick are laid in in courses and numerous pattern known as bond collectively known as brickwork and may be laid in various kind of mortar to hold the brickwork together to make a durable structure. A fiber is added to the brick in order to provide strength ie; water hyacinth scientifically known as *Eichhornia crassipes* is a free floating aquatic plant with broad, thick, glossy, ovate leaves which rises up to 1m in height . This can perform functions such as for bioenergy waste, water treatment, edibility. medicinal use ,temperature reduction etc. Water hyacinth are been dried and cut in to fiber form and mixes with the clay soil in 0, 1%,2%,3% . The mixture is been poured in mould in order to make brick. This is been dried under sunlight and the strength is been calculated by comparing with normal brick. A lime is been coated at the face of brick.

Keywords:brick,faces,lime, water hyacinth, red soil.

### I. INTRODUCTION

Temperature is one of the important factor that face by human. Temperature may be hot or cold. In a year 75% of the month be like summer season. We can't able to completely avoid this situation but we can reduce it mainly in construction using passive brick. Water hyacinth is a plant which helps to maintain temperature level thus we can reduce energy consumption .Thus we introduce this plant in a fibre form mixing with clay soil (Red soil) .This fibre also play a major role in providing strength

Water hyacinth is a free-floating perineal aquatic plant with broad, thick, glossy, ovate leaves, water hyacinth may rise above the surface of the water as much as 1 meter in height. The leaves are 10–20 cm across on a stem which is floating by means of buoyant bulb like nodules at its base above the water surface. They have long, spongy and bulbous stalks. The additionally can produce thousands of seeds each year, and these seeds can remain viable for more than 28 years. Because of its extremely high rate of development, *Eichhornia crassipes* is an excellent source of biomass. One hectare (2.5 acres) of standing crop thus produces more than 70,000 m<sup>3</sup>/ha (1,000,000 cu ft/acre) of biogas (70% CH<sub>4</sub>). Bengali farmers collect and pile up these plants to dry at the onset of the cold season; they then use the dry water hyacinths as fuel. The ashes are used as fertilize. The roots of *Eichhornia crassipes* naturally absorb pollutants, including lead, mercury, and strontium-90, as well as some organic compounds believed to be carcinogenic, in concentrations 10,000 times that in the surrounding water. Water hyacinths can be cultivated for waste water treatment (especially dairy waste water).It also helps in reduction of temperature.

Lime is a calcium-containing inorganic mineral composed primarily of oxides, and hydroxide, usually calcium oxide and/ or calcium hydroxide. It is also the name for calcium oxide which occurs as a product of coal-seam fires and in altered limestone xenoliths in volcanic ejecta. The word *lime* originates with its earliest use as building mortar and has the sense of *sticking or adhering*. These materials are still used in large quantities as building and engineering materials (including limestone products, cement, concrete, and mortar), as chemical feedstocks, and for sugar refining, among other uses.

Lime has many complex qualities as a building product including workability which includes cohesion, adhesion, air content, water content, crystal shape, board-life, spreadability, and flowability; bond strength; compressive strength; setting time; sand-carrying capacity; hydrolocity; free lime content; vapor permeability; flexibility; and resistance to sulfates. Limewater is the common name for a dilute

aqueous solution of calcium hydroxide. Calcium hydroxide,  $\text{Ca(OH)}_2$ , is feathery, freely hanging roots are purple-black. An erect stalk supports a single spike of 8–15 conspicuously attractive flowers, mostly lavender to pink in colour with six petals. When not in bloom, water hyacinth may be mistaken for frog's-bit. Each plant

sparsely soluble at room temperature in water (1.5 g/L at 25 °C. "Pure" (i.e. less than or fully saturated) limewater is clear and colorless, with a slight earthy smell and an astringent/bitter taste. It is basic in nature with a PH of 12.4. Limewater may be prepared by mixing calcium hydroxide ( $\text{Ca(OH)}_2$ ) with water and removing excess undissolved solute (e.g. by filtration). When excess calcium hydroxide is added (or when environmental conditions are altered.

Red soil is a type of soil that develops in a warm, temperate, moist climate under deciduous or mixed forest, having thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an illuvium red layer. Red soils are generally derived from crystalline rock. They are usually poor growing soils, low in nutrients and humus and difficult to be cultivated because of its low water holding capacity. The texture of red soil varies from, sand to clay, the majority being loam. Their other characteristics include porous and friable structure, absence of lime, kankar and free carbonates, and small quantity of soluble salts. Their chemical composition include non-soluble material 90.47%, iron 3.61%, aluminium 2.92%, organic matter 1.01%, magnesium 0.70%, lime 0.56%, carbon dioxide 0.30%, potash 0.24%, soda 0.12%, phosphorus 0.09% and nitrogen 0.08%. However significant regional differences are observed in the chemical composition. Due to presence of haematite and limonite its colour ranges from red to yellow.

## II. OBJECTIVE

The main objective of this project are :

- To reduce energy consumption without using electricity.
- To maintain thermal condition during summer season.
- To reduce the maintenance cost when compared to concrete structures.
- Most economical method without causing damage to environment and health.

### “VALUABLE PRODUCT FROM HYACINTH”(2018)- Mukesh Dwivedi;

**Anjani kumar Dwivedi volume 5** . This paper deals with the characteristic and constituent of water hyacinth and also their valuable product like bio ethanol, bio gas, bio hydrogen , bio fertilizer and uses like fish weed. They concluded that from the study they identifies that commercial method should be developed to control and removing of water hyacinth.

### “ASSESSMENT OF NUTRITIONAL QUALITY OF WATER HYACINTH LEAF PROTEIN CONCENTRATE”(2016)- Oyeyemi Adeyemi

Chris.c.Osuhor. This paper deals with the study which convert water hyacinth on environmental nuisance to a natural resources for economic . Water hyacinth leaf protein concentrate (WHLPC ) was extracted in to eligible form and determine its physical chemical characteristic ,total alkaloids phenolic development . Water hyacinth compound was done. It conclude that WHLPC is a good source of leaf protein concentrate . It is nutritious and non toxic . They contain heavy element and other bio elements. Water hyacinth can take up heavy metal and other pollutant from water due to strong anion and cation present in it.

### “INVASIVE AQUATIC PLANT”(2017) -Tarek

**Ahb El-Ghafer** Elshahaway, Muhamoud Ahmed Khater, Fida Ahmed Sharare **volume 3 deals** with the growth of water hyacinth different water mainly irrigation, drainage, sewage water. The physiochemical properties and heavy metals of water samples are evaluated and they conclude that they act as a magnet. They attracted and accumulate heavy metals in their in their root tissue and also they conclude that water hyacinth is a exceptional plant. The superior adaptivity of this plant is the both adverse and unfavorable growth condition put it in the rank of the plant with phytoextraction properties that can be relived up to the future in the remedial of heavy metal polluted water.

**STUDY ON THE UTILISATION OF CEMENT MIXON RED SOIL AS SUB-BASE ANDBASECOURSEMATERIAL”(2018)Kammaj osyula Sharmila volume 6** deals with the their composition and characteristic to manage the load transfer mechanism . In order to improve the strength and stability characteristic of red soil for supporting the road traffic cement stabilization was proposed.From this sand and cement are used to improve quality and addition of cement to improve CBR value.

**THE STUDY OF BEHAVIOUR OF RED SOIL CEMENT CONCRETE” (2016)- S Alexander,James Alexander ,Antony Godurn volume 3** with this paper deals with the study of replacement of fine aggregate with red soil. It involves the test to find the quality for improvement of concrete when red soil is added. Partial replacement of sand with red soil has been done for specific ratio to attain good strength. Mechanical and durable test can also be done . In case of chemical property by replacing red soil it is found that it is pest control. From this they conclude that red soil is suitable for concrete as an admixture which can be used for construction.

**“PROPERTIES OF LATERITE SOIL FOR POLLUTANTCONTAMINENT ”(2011) - Maria Eugenia,Gimenez Boscor,Walderinar, Coelho Huichch,Claudo Fernando Machler,Elisaheth De Oliveria volume 2** this paper shows that in many areas red soil is considered as main ingredient for Constituent of compacted clay liner of waste disposal site because of their availability and appropriate geotechnical characteristic .The paper describe that the characteristic of laterite soil representing a group of soil of significant occurrence and laboratory test are done and it shows the modest capacity to retain cadmium and their constituent metals. Oxide may be dissolved from the soil grain by acidic solution.

**“SOIL STABILIZATION USING LIME” (2013)- Anlut singh Neg,Mohammed Faizan, Devashish Pondey Siddharth,Rehanjot Singh volume 2** .It explain about the properties of chemical or physical means in order to enhance the engineering quality of soil. Soil stabilization is to increase the bearing capacity of soil its resistance to weathering process and permeability and the complete analysis of improvement of soil properties. stabilization using lime and it conclude that lime is a excellent.stabilization material and it impress various properties of soil such as bearing capacity of soil, resistance to shrinkage due to moist condition, plasticity etc.

**“SOIL IMPROVEMENT WITH LIME” (2012)- Parampreet Kaur ,Gurdeep Singh volume 1** issues this paper shows that the design of pavement based on premises that minimum structural specified quality will be achieved for each layer of material in the pavement system. In order to avoid deflection we can increase the quality of soil layer so that the ability of soil layer for load distribution on an area is increased so that the reduction is required in thickness of soil and surface layer is permitted . This journal focus on the construction aspect of treating soil with lime and it conclude that soil with lime is more stable. It gain compressive strength on addition of lime but only up to certain % age of lime and then start decreasing with increase in age of reaction between lime and soil.

**“EXPERIMENTAL STUDY ON STRENGTH OF WATER HYACINTH ASH AD THEIR AS PARTIAL REPLACEMENT OF CEMENT IN CONCRETE”(2018)- Krishna s,Murugesh V volume 9** issues that this paper have been done to evaluate water hyacinth ash in the replacement of cement and it also reveals that different propotion of water hyacinth ash cement which affect the properties of workability, compression,and split tensile strength of concrete.It is caste with different ratio and compare this with conventional concrete . This paper conclude that the optimum dosage of partial alternative of cement by water hyacinth ash is 10%. The compressive strength of concrete decreases when the addition of dosage is more than 10% and it shows this as 20%.

1. Water hyacinth can be used in many forms and it helps to reduce temperature mainly in underwater due to its spreading of roots.
2. Water hyacinth leaf protein concentrate is formed from hyacinth which is non toxic and nutritious and can take heavy metal and other pollutant from water due to strong anion and cation present in it.
3. The physiochemical properties of water hyacinth act as a magnet and they attract , accumulate heavy metals in their root tissue.
4. Red soil increase the strength and improves the CBR value.
5. Replacement of fine aggregate as red soil is more economical and durable as that of normal concrete.
6. Red soil is used in many construction field such as waste disposal clay liner because of its property.
7. Soil stabilization using lime is a excellent gradient because of its bearing capacity.
8. compressive strength can be improved by adding soil with lime.
9. Partial replacement of cement with water hyacinth ash can increase compressive strength,tensile strength etc of dosage 10%.

### 3.1.1 WATER HYACINTH

Water hyacinth is a free-floating perineal aquatic plant with broad, thick, glossy, ovate leaves, water hyacinth may rise above the surface of the water as much as 1 meter in height. The leaves are 10–20 cm across on a stem which is floating by means of buoyant bulb like nodules at its base above the water surface. They have long, spongy and bulbous stalks. The feathery, freely hanging roots are purple-black. An erect stalk supports a single spike of 8–15 conspicuously attractive flowers, mostly lavender to pink in colour with six petals. When not in bloom, water hyacinth may be mistaken for frog's-bit. Each plant additionally can produce thousands of seeds each year, and these seeds can remain viable for more than 28 years.

Because of its extremely high rate of development, *Eichhornia crassipes* is an excellent source of biomass. One hectare (2.5 acres) of standing crop thus produces more than 70,000 m<sup>3</sup>/ha (1,000,000 cu ft/acre) of biogas (70% CH<sub>4</sub>). Bengali farmers collect and pile up these plants to dry at the onset of the cold season; they then use the dry water hyacinths as fuel. The ashes are used as fertilize. The roots of *Eichhornia crassipes* naturally absorb pollutants, including lead, mercury, and strontium-90, as well as some organic compounds believed to be carcinogenic, in concentrations 10,000 times that in the surrounding water. Water hyacinths can be cultivated for waste water treatment (especially dairy waste water).It also helps in reduction of temperature.

### PROPERTIES OF WATER HYACINTH

- Highly reproductive sexually and by stem extension and grows very fast.
- Flowering plant ; numerous long feathery root.

- Spongy trunk and large leaves ; absorb so much water.
- It survives floating and anchored.
- Mineral composition H<sub>2</sub>O=95%.
- Organic matter; silica=50%,k=30%,N=20%,protein=5%
- Not suitable for direct fertiliser use.

|                  |      |
|------------------|------|
| TOTAL EXTRACTION | 29.5 |
|------------------|------|

**PHYSICAL PROPERTIES**

| PROPER TIES       | STANDERD VALUE                | VALUE BASED ON PRESE NT STUDY |
|-------------------|-------------------------------|-------------------------------|
| MOISTURE CONTENT  | 8-52%wb                       | 19wb%                         |
| BULK DENSITY      | 0.048-0.074g cm <sup>3</sup>  | 0.048 gcm <sup>3</sup>        |
| TRUE DENSITY      | 0.0406-0.997gc m <sup>3</sup> | 0.0406gc m <sup>3</sup>       |
| POROSITY          | 69.6-91.6%                    | 71.3%                         |
| FINESS            | -                             | 10%                           |
| TERMINAL VELOCITY | 8-52%                         | 36%                           |
| SPECIFIC GRAVITY  | -                             | 2.12                          |

**CHEMICAL PROPERTY**

| PROPERTIES        | RESULT |
|-------------------|--------|
| PH                | 4.6    |
| ALKALI SOLUBILITY | 48.9%  |
| RUNKEL LIGNIN     | 12.18  |
| CELLULOSE         | 33.12  |
| HEMICELLULOSE     | 18.24  |
| CRUDE PROTEIN     | 6.2    |
| ASH               | 11.2   |
| CRUDE FIBER       | 11.5   |
| MOISTURE          | 8.5    |

| PROPERTIES | VALUE  |
|------------|--------|
| CALCIUM    | 20.75% |
| SODIUM     | 19%    |
| POTASSIUM  | 40%    |
| MAGNESIUM  | 18%    |
| COPPER     | 12%    |
| ZINC       | 37%    |

**3.1.2 RED SOIL**

Red soil is a type of soil that develops in a warm, temperate, moist climate under deciduous or mixed forest, having thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an illuvium red layer. Red soils are generally derived from crystalline rock. They are usually poor growing soils, low in nutrients and humus and difficult to be cultivated because of its low water\_holding capacity

The texture of red soil varies from, sand to clay, the majority being loam. Their other characteristics Include porous and friable structure, absence of lime, kankar and free carbonates, and small quantity of soluble salts. Their chemical composition include non-soluble material 90.47%, iron 3.61%, aluminium 2.92%,organic matter 1.01%, magnesium 0.70%, lime 0.56%, carbon dioxide 0.30%, potash 0.24%, soda 0.12%, phosphorus 0.09% and nitrogen 0.08%. However significant regional differences are observed in the chemical\_composition.

Due to presence of haematite and limonite its colour ranges from red to yellow.

- Red soil is formed due to weathering of igneous and metamorphic rock
- Easily available in tamil nadu, Madhya Pradesh, Karnataka, Orissa etc.
- The red colour is due to the presence of iron content.
- The texture of red soil varies from sandy to clayey and the majority being loamy

| PROPERTIES   | RESULT                |
|--------------|-----------------------|
| PH           | 6.4                   |
| BULK DENSITY | 0.81g/cm <sup>3</sup> |
| CLAY         | 59.3%                 |
| SILT         | 28.3%                 |
| SAND         | 12.4%                 |

### CHEMICAL PROPERTIES

| PROPERTIES | VALUE        |
|------------|--------------|
| P          | 4.81mg/kg    |
| K          | 27.16 mg/kg  |
| Ca         | 133.22 mg/kg |
| Mg         | 20.99 mg/kg  |
| Na         | 62.18 mg/kg  |
| Al         | 45.38 mg/kg  |
| Fe         | 44.52 mg/kg  |
| Cu         | 0.57 mg/kg   |
| S          | 85.22 mg/kg  |
| Zn         | 3.86 mg/kg   |

earliest use as building mortar and has the sense of *sticking or adhering*. These materials are still used in large quantities as building and engineering materials (including limestone products, cement, concrete, and mortar), as chemical feedstocks, and for sugar refining, among other uses.

Lime has many complex qualities as a building product including workability which includes cohesion, adhesion, air content, water content, crystal shape, board-life, spreadability, and flowability; bond strength; comprehensive strength; setting time; sand-carrying capacity; hydrolocity; free lime content; vapor permeability; flexibility; and resistance to sulfates. Limewater is the common name for a dilute aqueous solution of calcium hydroxide. Calcium hydroxide, Ca(OH)<sub>2</sub>, is sparsely soluble at room temperature in water (1.5 g/L at 25 °C. "Pure" (i.e. less than or fully saturated) limewater is clear and colorless, with a slight earthy smell and an astringent/bitter taste. It is basic in nature with a PH of 12.4.

### 3.1.3 LIME

Lime is a calcium-containing inorganic mineral composed primarily of oxides, and hydroxide, usually calcium oxide and/ or calcium hydroxide. It is also the name for calcium oxide which occurs as a product of coal-seam fires and in altered limestone xenoliths in volcanic ejecta. The word *lime* originates with its

Limewater may be prepared by mixing calcium hydroxide (Ca(OH)<sub>2</sub>) with water and removing excess undissolved solute (e.g. by filtration). When excess calcium hydroxide is added (or when environmental conditions are altered, e.g. when its

results due to the homogeneous suspension of excess calcium hydroxide. This liquid has been known traditionally as *milk*.

| PROPERTIES                                | STANDARD VALUES | VALUE BASED ON PRESENT STUDY |
|---|-----------------|------------------------------|
| LIME (Cao)                                | 38 to 42%       | 40%                          |
| SILICA (Sio <sub>2</sub> )                | 20 to 25%       | 23%                          |
| ALUMINA (Al <sub>2</sub> O <sub>3</sub> ) | 2 to 4%         | 3%                           |
| OTHER OXIDES LIKE Na,Mg                   | 1.5 to 2.5%     | 2%                           |
| LOSS ON IGNITION (LOI)                    | 30 to 32%       | 30%                          |

**PROPERTIES OF LIME**

| PROPERTIES           | STANDARD VALUE               | VALUE BASED ON PRESENT STUDY |
|----------------------|------------------------------|------------------------------|
| HARDNESS             | 3-4 on Moh's scale           | 3 Moh's scale                |
| DENSITY              | 2.5-2.65 kg/m <sup>3</sup>   | 2.5 kg/m <sup>3</sup>        |
| COMPRESSIVE STRENGTH | 1800-2100 kg/cm <sup>2</sup> | 1900 kg/cm <sup>2</sup>      |
| WATER ABSORPTION     | LESS THAN 1 %                | 0.9%                         |
| POROSITY             | -                            | QUIT LOW                     |
| WEATHER IMPACT       | -                            | RESISTANT                    |

**PROPERTIES OF LIME**

- Slaking of lime is the process of chemical combination of lime with water so the end product is hydrated lime.

- When lime cannot absorb any more water then the process is complete
- Fat lime is hydrated in 3-4 hours and hydraulic lime in 1-3 days.
- All lime must be slaked before use in construction.

**3.1.4 WATER**

Water is an important in gradient of concrete as it activity participates in the chemical reactions with cement. It get the requirement of water should be reduced that required chemical reaction due to excess water would end up in only formation undesirable voids (or) capillaries ..It is important to have the compatible between the given soil and the fibre along with the water used for mixing. It is generally stated in .This may not be true always.it is suitable for drinking, as they good for soil as the sugar would adversely affect the hydration process. The limits of the content of water have to be determined from the following consideration. High content of red soil is susceptible to a rapid loss of workability on account of higher amount of heat hydration generated. Therefore, attention is required to see that the intial hydration of soil should not significantly affect..The salt in water would not interface with the development of strength of later gases. Apart from the strength consideration, the durability characteristics such as porosity, degree of resistance to diffiussion of CO<sub>2</sub>,

CaSO<sub>4</sub> moisture, air oxygen etc... It should also be investigated after specified curing period.

#### IV. TEST AND RESULT

##### 1 SPECIFIC GRAVITY TEST

Specific gravity is done by pycnometer test.

It is been weighted in four different cases that is empty weight (M1), empty dry soil(M2),water +dry soil(M3), pycnometer filled with water(M4).

$$G = \frac{(M2-M1)}{(M2-M1)-(M3-M4)} = 2.7$$



##### 2 MOISTURE CONTENT

Weight of 200g of wet soil using weighing machine. Place this wet soil under sunlight for 24 hours and weight it again.

$$\text{MOISTURE CONTENT} = \frac{200-180}{180} = 20\%$$

- Casagrande liquid limit device is used which consist of cup with moving up and down mechanism.
- The cup is filled with soil sample and groove is created at the middle of cup.
- The cup is moved up and down with the help of handle to make the groove to become closer at some point.

LIQUID LIMIT = 35.7%



##### 4 PLASTIC LIMIT

- The soil sample is added with water and make it into small balls.
- Leave it for some time and after that put the ball into the glass plate and roll it into 3mm dia.
- If the thread does not break then water content is more than plastic limit.
- In that case reduce the water content and repeat the procedure until crumbling occur.





## 5. SHRINKAGE LIMIT

- The water content in the soil is just sufficient to fill the void of soil.
- Initial volume and initial mass has been calculated and it is been dried and been weighted.

$$W_s = (m_1 - m_2) - (v_1 - v_2)pw / (m_2)$$

$$= 20\%$$

## V. REFERENCE

EGYPTIAN JOURNALS OF AQUATIC RESEARCH,  
“VALUABLE PRODUCT FROM HYACINTH”(2018)-  
Mukesh Dwivedi; Anjani kumar Dwivedi volume 52222

ASSESSMENT OF NUTRITIONAL QUALITY OF  
WATER HYACINTH LEAF CONCENTRATION

INVASIVE AQUATIC PLANT”(2017) -Tarek Ahb  
El-Ghafer **Elshahaway, Muhamoud Ahmed  
Khater, Fida Ahmed Sharare**

” A STUDY ON THE UTILISATION OF CEMENT  
MIXON RED SOIL AS SUB-BASE  
ANDBASECOURSEMATERIAL”(2018)Kammajos  
yula **Sharmila**

THE STUDY OF BEHAVIOUR OF RED SOIL  
CEMENT CONCRETE” (2016)- S Alexander,**James  
Alexander ,Antony Godurn**

“PROPERTIES OF LATERITE SOIL FOR  
POLLUTANTCONTAMINENT ”(2011) -Maria  
**Eugenia, Gimenez Boscó, Walderinar, Coelho  
Huichch, Claudio Fernando Machler, Elisabeth De  
Oliveria** volume 2

THE STUDY OF BEHAVIOUR OF RED SOIL  
CEMENT CONCRETE” (2016)- S Alexander,**James  
Alexander ,Antony Godurn** volume 3

“PROPERTIES OF LATERITE SOIL FOR  
POLLUTANTCONTAMINENT ”(2011) -Maria  
**Eugenia, Gimenez Boscó, Walderinar, Coelho  
Huichch, Claudio Fernando Machler, Elisabeth De  
Oliveria** volume 2

“SOIL IMPROVEMENT WITH LIME” (2012)-  
Parampreet Kaur ,**Gurdeep Singh** volume 1