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OMICS Group International is an amalgamation of Open Access publications and worldwide international science conferences and events. Established in the year 2007 with the sole aim of making the information on Sciences and technology 'Open Access', OMICS Group publishes 400 online open access scholarly journals in all aspects of Science, Engineering, Management and Technology journals. OMICS Group has been instrumental in taking the knowledge on Science & technology to the doorsteps of ordinary men and women. Research Scholars, Students, Libraries, Educational Institutions, Research centers and the industry are main stakeholders that benefitted greatly from this knowledge dissemination. OMICS Group also organizes 300 International conferences annually across the globe, where knowledge transfer takes place through debates, round table discussions, poster presentations, workshops, symposia and exhibitions.

About OMICS Group Conferences

OMICS Group International is a pioneer and leading science event organizer, which publishes around 400 open access journals and conducts over 300 Medical, Clinical, Engineering, Life Sciences, Phrama scientific conferences all over the globe annually with the support of more than 1000 scientific associations and 30,000 editorial board members and 3.5 million followers to its credit.

OMICS Group has organized 500 conferences, workshops and national symposiums across the major cities including San Francisco, Las Vegas, San Antonio, Omaha, Orlando, Raleigh, Santa Clara, Chicago, Philadelphia, Baltimore, United Kingdom, Valencia, Dubai, Beijing, Hyderabad, Bengaluru and Mumbai.

Development of Sisal Fibre Reinforced Cement Composites As substitute of Asbestos Cement Composites

-A Green Chemical Approach

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- Need for economical, sustainable and safe shelter - well pronounced globally.

- Numerous challenges are unaddressed to produce eco-friendly construction materials which are structurally safe and durable.



- Roofing - one of the most important components in housing.
- Alone represents more than 25-30% of the total construction cost of a house.
- In India, mostly asbestos cement roofing sheets are being used as one of the major roofing element.

- There is need of millions of tons of asbestos roofing products.
- Use of asbestos fiber for making asbestos cement roofing sheet causes many health problems.
- It is a carcinogenic material.

- Asbestos group of naturally occurring hydrated minerals silicates has been shown to induce:

  -fibrosis, -lung cancer,- other kinds of intestinal cancer.

.

- Long exposure to high concentrations of asbestos fibers is more likely to cause health problems.

- Use of synthetic fibers frequently - higher costs and greater consumption of energy in the processing of fiber reinforced cement composites.

- Great need to replace asbestos (mineral fibre) by eco-friendly materials.

- Plant fibres - renewable, eco-friendly and have good mechanical properties.



- Plant fibres- an appropriate alternative to asbestos.
- Plant fibers- deals with eco-friendly processing.
- The environment - safe since the plant fibers require little energy with no toxic wastes.



Green Chemistry

The **International Year of Natural Fibres 2009** aims at

- raising global awareness of the importance of natural fibres
- not only to producers and industry, but also to
- **consumers** and
- the **environment**.



CLASSIFICATION OF NATURAL FIBRES

Vegetable (Cellulose)

Animal (Protein) Wool, Silk

Mineral Asbestos

Seed Hair Fibres Cotton, Kapok, Coir

1. Obtained from seeds and inner wall of the fruit
2. Short & single celled

Bast Fibres Flax, Hemp, Jute

1. Obtained from bast tissue of bark
2. Long multi-celled

Leaf Fibres Sisal

1. Obtained from the leaves
2. Long multi-celled



Sisal Plant



Sisal fibre

- **Agave *sisalana* :- family - Agavaceae**

- **Sisal: Wide applications.**

- **Present uses of Sisal fibre:**
  - **Ropes, cordage, twines, cables, anchors, binders**
  - **Coarse fabrics: nets, door mats, rugs, carpets etc.**
  - **Others: hats, sandals, brushes**
  - **Reinforcement in various polymeric matrices**

- **Sisal fibre waste : Used for making paper and paper board, biogas, electricity etc.**



- Sisal fiber - one of the widely available natural fiber.
- Eco-friendly.
- Good mechanical strength, locally available, and easy cultivation in all climatic conditions
- Viable substitute for asbestos based roofing sheet.

Why Sisal Fiber?

- Low density
- High specific strength
- Renewable resource
- Biodegradable
- Thermal and acoustic insulation



Why Sisal Fiber?

- Xerophyte.
- Abundantly grown in wastelands and conserve soil.
- Requires Minimum Maintenance
- Bio renewable material.
- Withstands many agro-ecological conditions.



Why Sisal Fiber?

- Continuous fibre production for 6 - 8 years.
- Require no fertilizers, herbicides or insecticides.
- Largest export potential for ropes and binder twine.
- Excellent engineering properties (light weight, high strength).
- Compete with high end engineering product while having tremendous employment potential.



SISAL FIBRE EXTRACTION

Manual Process – Retting

- Microbial decomposition of sisal leave

Boiling

- Leaves are boiled
- Beating
- Washing and Sun drying

Mechanical

- By Raspador Machine
  <u>Best method in all aspects</u>



Raspador Machine


MACHINE

- The raspador , run by electric motor is effecient, versatile, safe ,labor and cost effective.
- It takes minimum time and is an eco-friendly process.
- About 96 % residues available after extraction of fibre is useful for other applications
- As biogas generation, composting, isolation of hecogenin, which is a steroid.
- Also being used for making paper, paperboard, and biodegradable polymer, wax etc.



Combing Machine




Combing Machine



Sisal Plant



Green Sisal Fibre



Sisal Fibre

- Sisal fiber, the green material-exceptionally durable with low maintenance and minimal wear and tear.
- Tough for textiles and fabrics.
- Biodegradable too.
- Easily grow in every climate covering sub humid to arid and semiarid regions.



- Sisal - 6th most commonly produced fibre globally.
- Accounts for 2%of the world's plant fibre production.
- Sisal plant - survives in almost all soil types.
- Input costs - least for its survival, regeneration and maintenance on sustainable basis.
- Tolerates prolonged droughts and high tematures also.
- It yields parallel hard fibers.



Physico-Chemical Parameters

- Tensile Strength(Mpa)- 501.326 ± 119.5
- Tensile Modulus (Gpa)- 50.57 ± 3.27
- Elongation at break (%)- 0.78 ± 0.41 (ASTM)
  Universal Testing Machine of
  Ametek Lloyd
- Moisture Content (%) - 14-16
  By LCGC moisture absorption analyzer
- Density (g/cm3) - 1.4 (ASTM)



Phytochemical Analysis

- Carbon % - 40.0
- Nitrogen % - 0.112
- Sulphur % - 0.007
- Hydrogen % - 6.523

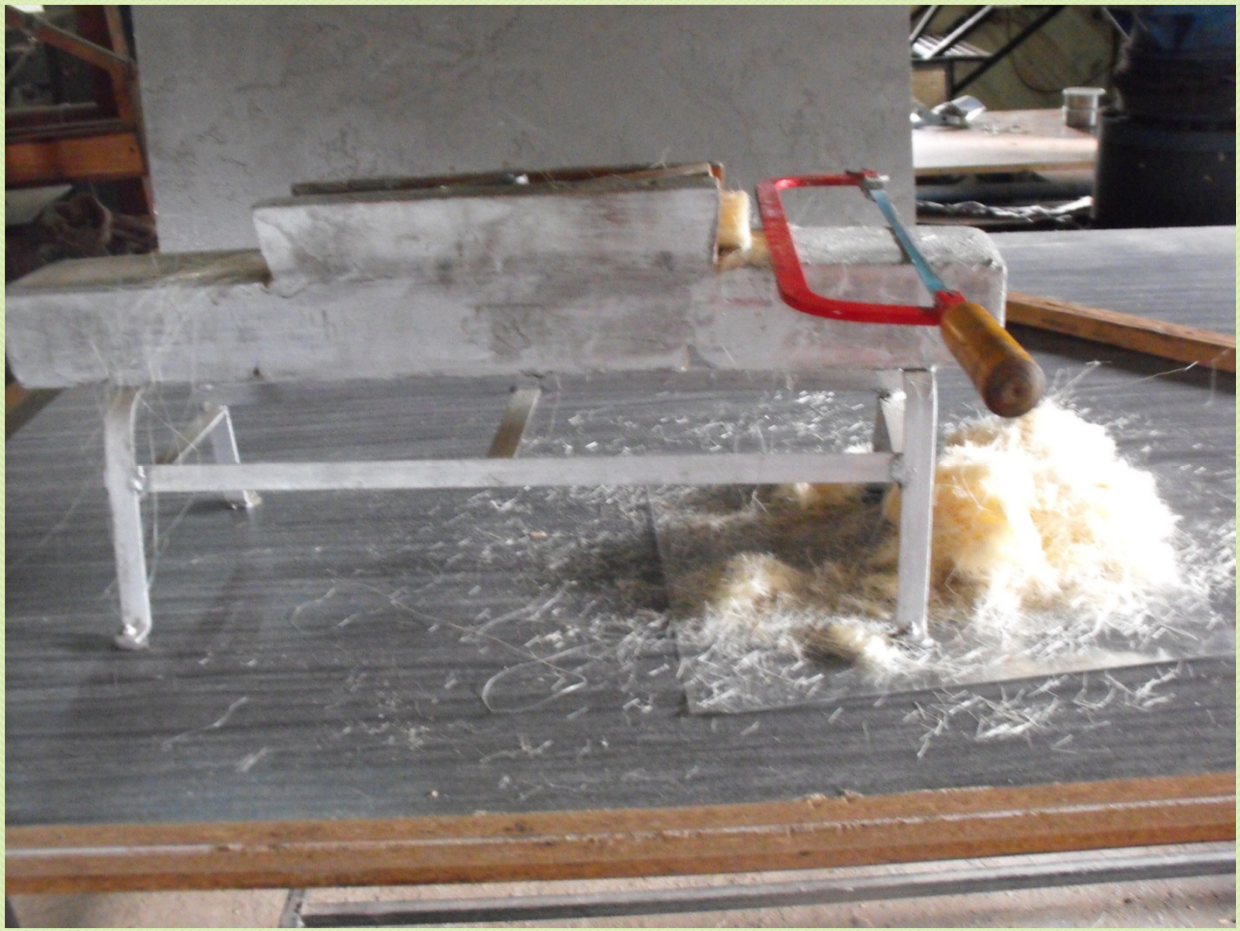
By CHNS Analyzer, Elementar ,
Vario EL, Germany

Phytochemical Analysis contd.

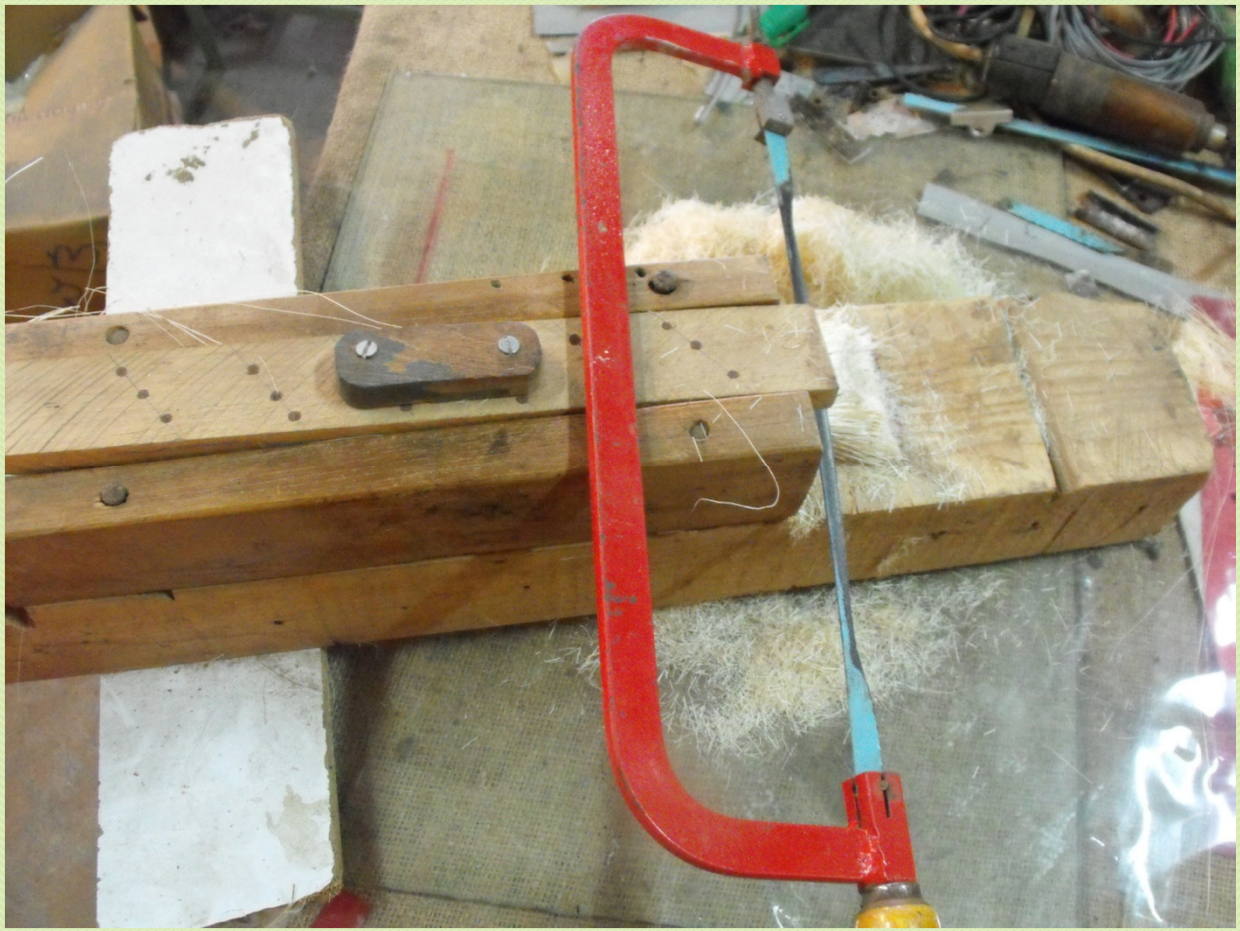
- Cellulose % - 45
- Lignin (%) - 18
- Hemi-cellulose(%) - 14

(Oladele et al 2010)

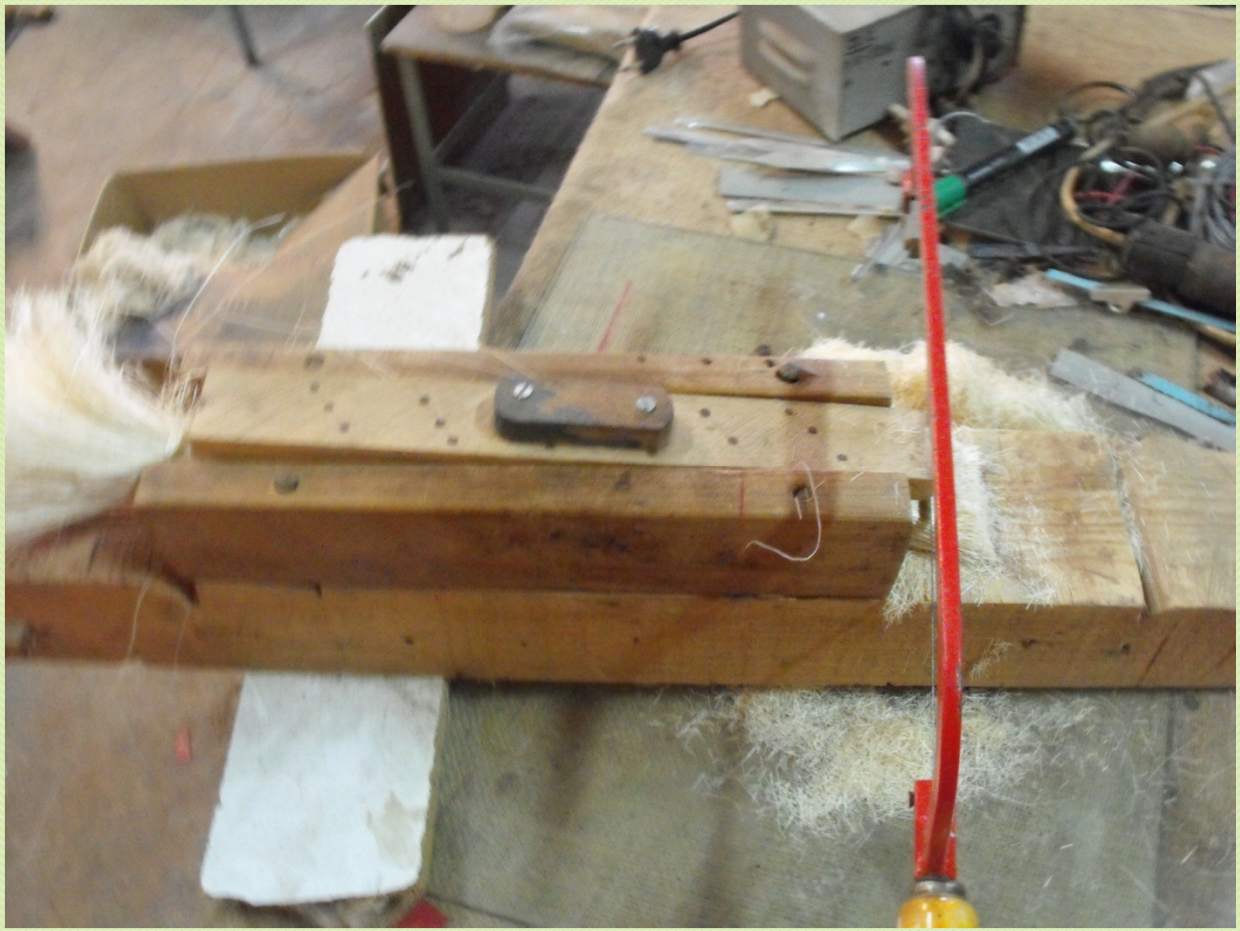
Chopping



Chopping



Chopping



Chopped Sisal Fibre



- The long fiber were chopped:
- Different sized samples were tested till 22-25 mm.
- The best results were observed with 5.0 mm size of the chopped fibre.
- The fibre is given alkali treatment with

  5% NaOH.
- Through washing with water.



- Excess alkali was neutralized.
- Finally dried in oven at 50^0C.
- Sisal fibre is mixed with cement and fly ash to develop sisal fiber reinforced cement composites.
- The green material was reinforced with cement/ cement and fly ash.
- Flay ash is industrial waste of power plants.



Mixing Drum



Mixing



Manual Agitation



Mixing



Composite Setting Mould



Composite Moulding



Hand Press Machine



Hand Press Machine



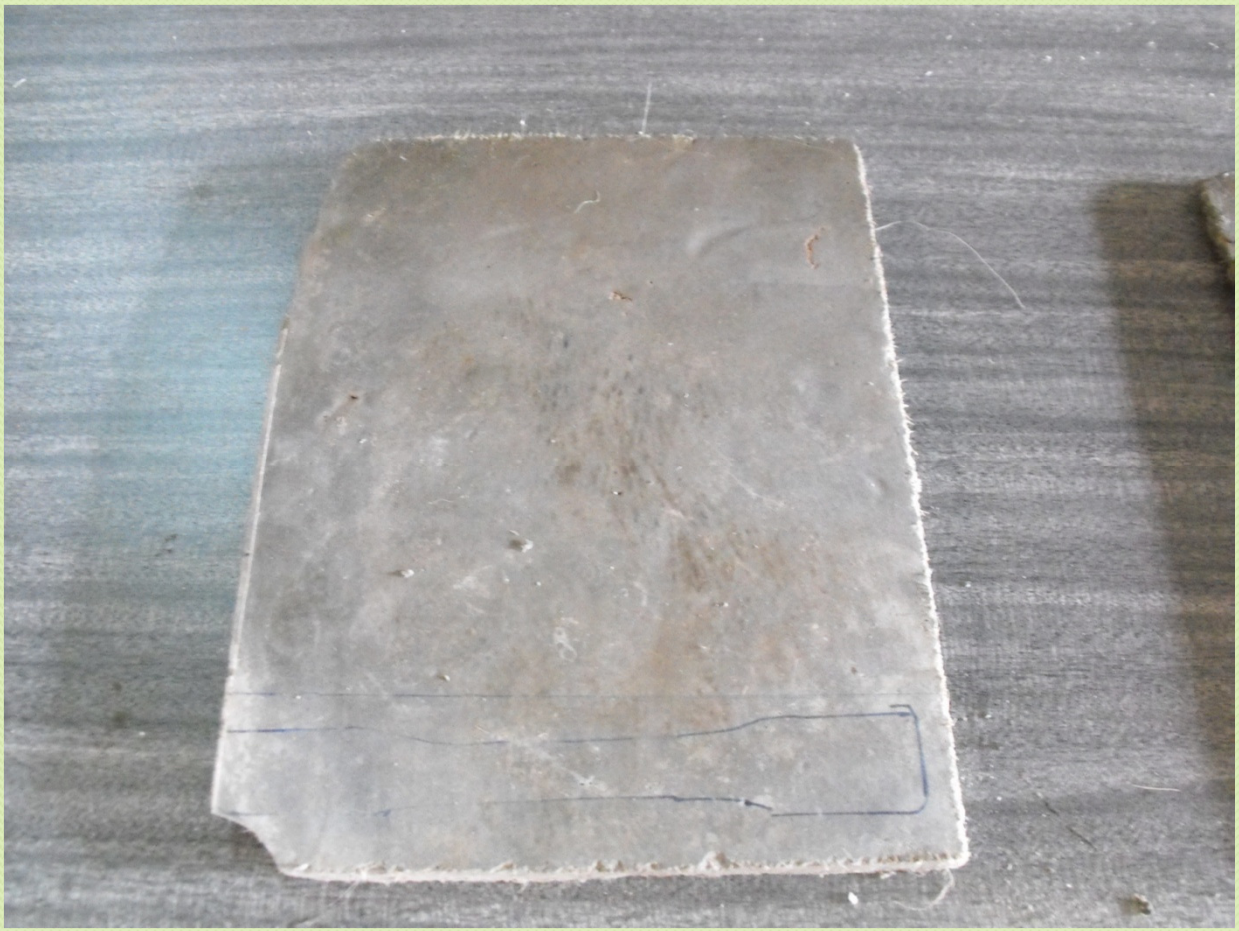
Sisal Fibre - Cement Composite

- Sisal Fibre (20gms,length 5mm)
- Cement (700gm)
- Water (400ml)
- Pressure (1500lb/m^2)

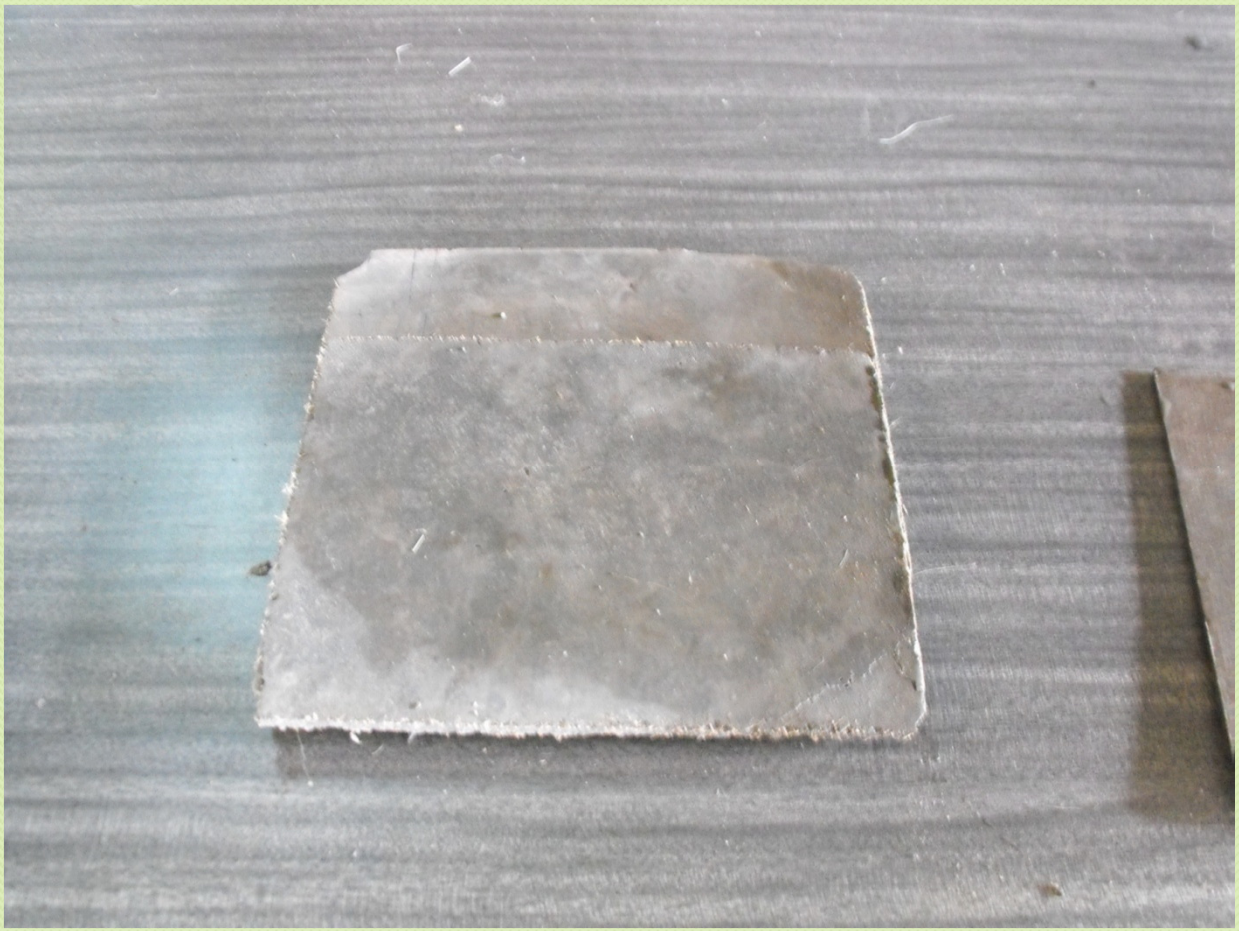
Sisal Fibre-Cement-Fly Ash Composite

- Sisal Fibre (20gms,length 5mm)
- Cement (600gm)
- Fly Ash (100gm)
- Water (400ml)
- Pressure (1500lb/m^2)

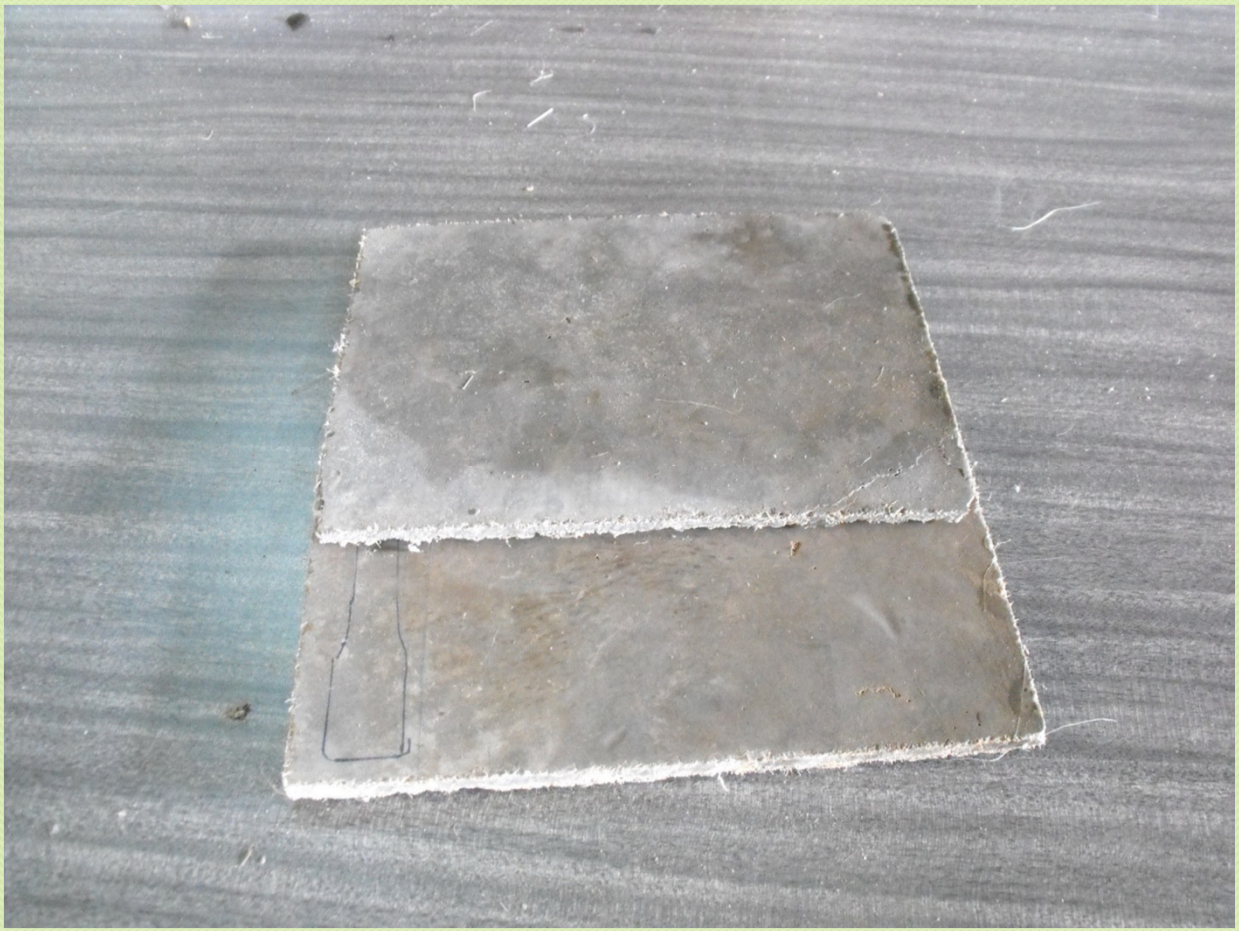
Sisal Fibre Reinforced Cement Composite Sheet



Sisal Fibre Reinforced Cement Composite Sheet



Sisal Fibre Reinforced Cement Composite Sheet



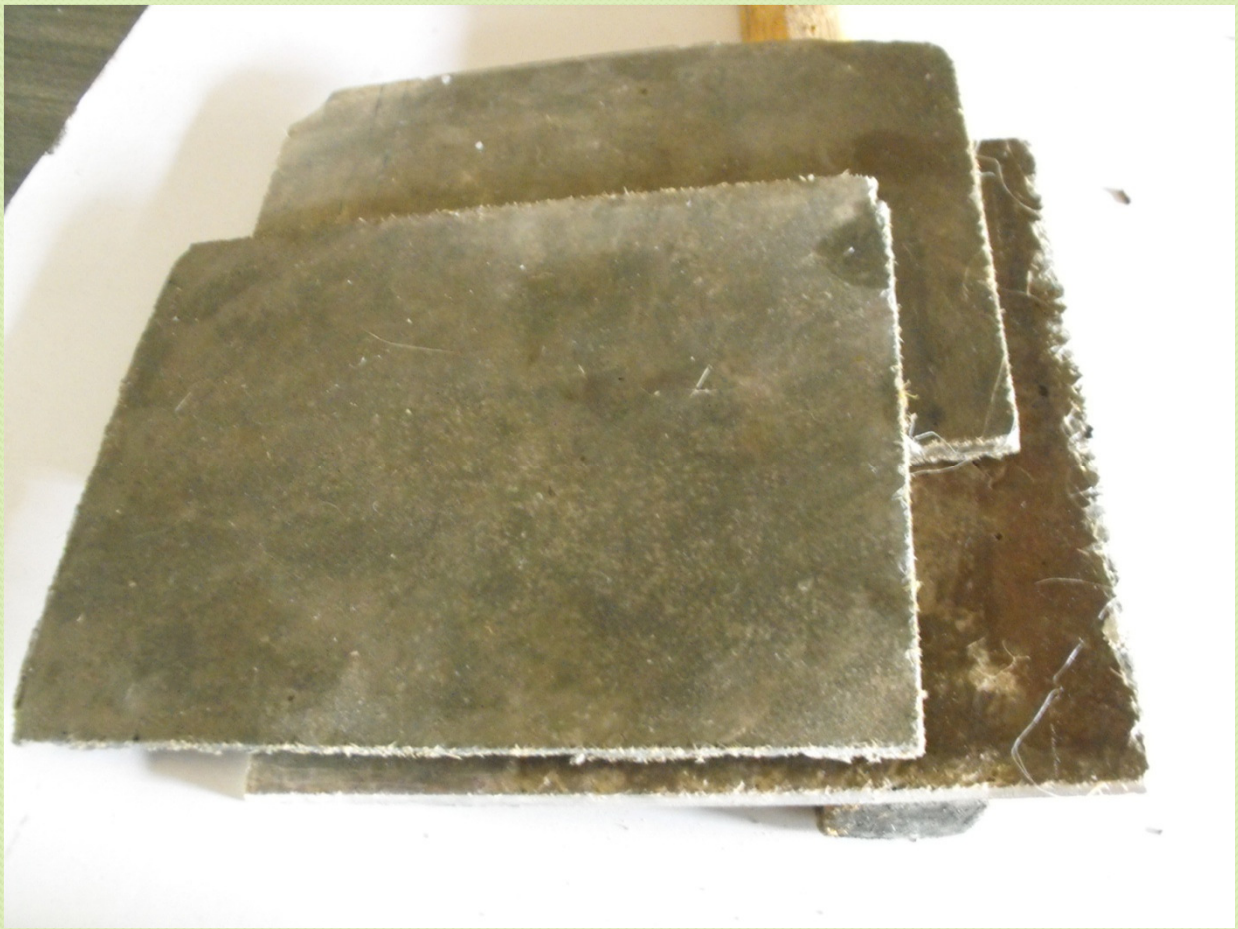
Sisal Fibre Reinforced Cement Composite Sheet



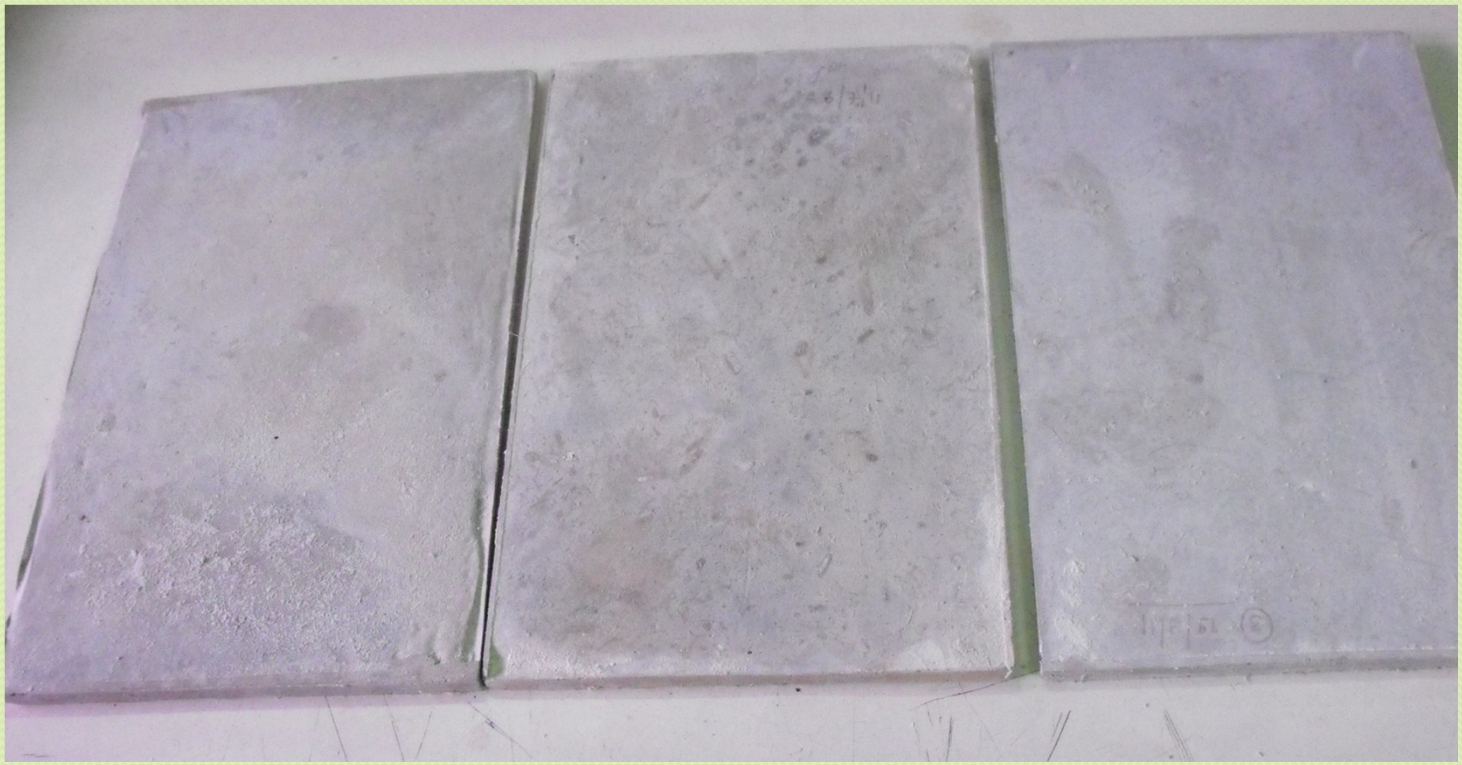
Sisal Fibre Reinforced Cement Composite Sheet



Sisal Fibre Reinforced Cement Composite Sheet



Sisal Fibre-Cement-**Fly Ash** Composite



Under Testing

- Moisture Analysis
- Water absorption
- Morphological Study (SEM-Scanning by Electronic Microscope)
- Tensile Strength
- Flexural Strength
- Elongation at break (%)
- Impact Strength etc.

- Utilization of a locally renewable resource (sisal) as a substitute of carcinogenic asbestos fibre.
- Present proposed development may open new avenue to use sisal fiber cement sheet in buildings where presently asbestos cement sheets are used globally.
- An Innovative and Inclusive Developmental Approach.



Biography:

- Dr. Shipra Roy has had a distinguished career, so far with over 33 years of research, teaching, and public advocacy in science. She has published scholarly research in national and international publications in chemistry, biochemistry and their applications. The major emphasis of her work has been on herbal medicine for diabetes and plant fibre reinforced cement composites. She has supervised Master's and Ph.D. level research work. Her research work has been patented in India and in the United States of America. During the course of her career, Dr. Roy has won several scholarships and awards. She holds M.Sc. and Ph.D. degrees from the University of Allahabad. For the M.Sc. she was first in merit. Currently, she is an Assistant Professor of Chemistry at the Sarojini Naidu Post Graduate Autonomous College and also an approved Ph.D. supervisor for the Barkatullah University, Bhopal, India.
- Official Website: WWW.shipraroygreenchemistry.com


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