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METHODS FOR DEVELOPMENT OF GEOTEXTILE MATERIAL FROM COIR FIBER.

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ABSTRACT :

This paper delves into the development of a geotextile material tailored for soil stabilization, enhancing road infrastructure. The study focuses on elucidating optimal production methodologies for geotextiles, incorporating advanced technologies such as miniature carding, needle punching, and thermal bonding. Integral to this innovative approach is the integration of synthetic fibers, specifically polypropylene, to augment material performance. Through meticulous experimentation and analysis, this research aims to establish a comprehensive understanding of the production process, ensuring the fabrication of geotextiles with superior structural integrity and durability. The utilization of polypropylene fibers offers notable advantages, including enhanced tensile strength, resistance to environmental degradation, and compatibility with various soil compositions. By elucidating the intricacies of geotextile fabrication and material composition, this study contributes valuable insights to the field of civil engineering, facilitating the development of sustainable and resilient road infrastructure.

Keywords: Geotextile, soil stabilization, road infrastructure, production methodologies, miniature carding, needle punching, thermal bonding, synthetic fibers, polypropylene, structural integrity, durability, tensile strength, environmental degradation, civil engineering, sustainable development.

INTRODUCTION:

Developing a geotextile material for soil stabilization is a project of paramount importance in contemporary civil engineering. The ancient civilization that intrigues me most in this context is the Mesopotamian civilization, particularly because of its remarkable advancements in infrastructure development. Mesopotamia, often regarded as the cradle of civilization, flourished in the fertile lands between the Tigris and Euphrates rivers, present-day Iraq and parts of Syria, Turkey, and Iran. What fascinates me about this civilization is its innovative solutions to challenges posed by the environment, particularly in the realm of construction and irrigation.

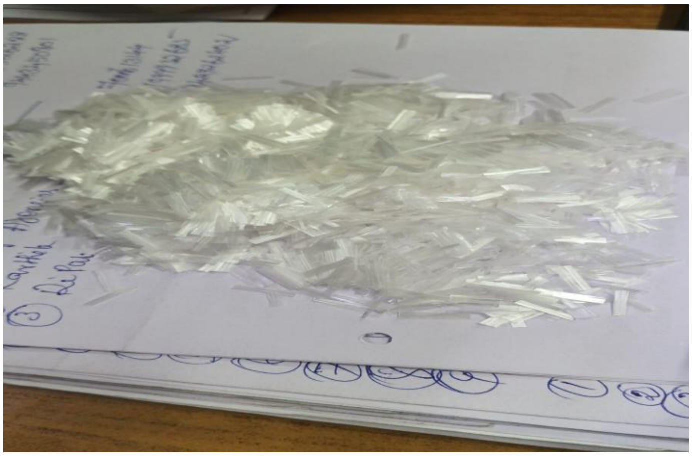
Mesopotamian engineers faced similar challenges to those we encounter today in road construction and soil stabilization. They developed sophisticated irrigation systems, such as canals and levees, to manage water flow and control flooding, laying the groundwork for modern hydraulic engineering. Additionally, they constructed roads using materials like clay and stones, employing techniques that contributed to the longevity and stability of their infrastructure.

Studying ancient civilizations like Mesopotamia can provide valuable insights and inspiration for our modern endeavors. By understanding how they tackled environmental challenges with limited resources and technology, we can adapt their principles to develop innovative solutions for contemporary issues like soil stabilization. Through this project, we aim to harness advanced technologies like miniature carding, needle punching, and thermal bonding, alongside synthetic fibers like polypropylene, to create geotextiles that enhance road structures and contribute to sustainable development.

In summary, the ingenuity of ancient civilizations like Mesopotamia serves as a guiding light as we embark on this journey to develop geotextile materials for soil stabilization. By drawing inspiration from their achievements and leveraging modern technologies, we strive to create solutions that not only address current challenges but also pave the way for a more resilient and sustainable future.

MATERIALS:

The materials which we are using here is coir fiber which we purchased from local coir fiber manufacturer in palladam and the polypropylene was purchased from Indian mart.



POLYPROPYLENE FIBER

METHODS OF PRODUCTION CARRIED

3.1 Miniature Carding: Incorporating miniature carding machines into our process for producing polypropylene web represents a crucial step in achieving the desired geotextile material for soil stabilization. However, the inherent challenge lies in the short fiber length of polypropylene, which measures only 12 mm. Such a limitation hampers the effectiveness of the web development process. To overcome this obstacle and ensure optimal performance of the geotextile, we have devised a strategic solution.

Recognizing the need for enhanced structural integrity and durability, we have introduced a complementary material: polyester. By blending polypropylene with polyester in a carefully balanced ratio of 80:20 (80% polypropylene and 20% polyester), we aim to capitalize on the respective strengths of both fibers. This synergistic blend not only addresses the fiber length constraint of polypropylene but also enhances the overall mechanical properties of the geotextile. Through meticulous experimentation and testing, we anticipate achieving optimal results in terms of fabric integrity, porosity, and tensile strength.

MINIATURE CARDIND MACHINE

3.2 INFUSING OF COIR FIBER

After successfully developing the polypropylene web using miniature carding technology, our next pivotal step involves integrating coir fiber into the geotextile structure for enhanced soil stabilization. However, the coarse nature of coir fiber, characterized by larger dust particles and harder substances, poses a unique challenge for processing. Given its unsuitability for conventional miniature carding techniques, we opted for an alternative approach: manually cutting down the coir fiber into significantly smaller-sized fibers and carefully spreading them across the polypropylene web. Despite being unable to develop a dedicated coir fiber web due to processing constraints, we devised an innovative solution to incorporate coir effectively. Utilizing a sandwich structure methodology, we strategically layered the cut coir fibers atop the polypropylene web before sealing them between another layer of developed web. This approach not only circumvents the limitations posed by the coir fiber's texture but also maximizes its presence within the geotextile. By employing coir in a larger ratio within this sandwich structure, we aim to leverage its natural

strength and permeability to augment the overall performance and longevity of the geotextile material in soil stabilization applications.

SANDWICH STRUCTURE

3.3 NEEDLE PUNCHING:

In the next phase, we wanted to use needle punching—a crucial procedure for applying geotextiles—to mechanically join the composite sample. But unexpected difficulties soon presented themselves, and the needles broke when they came into contact with the toughness of coir fiber. The machine, designed to work with materials similar to cotton, did not work well with the hardness of coir fibers. As such, our efforts to use needle punching to obtain the required structural integrity were unsuccessful. This setback forces us to reevaluate our strategy to guarantee that the qualities of the material and the processing equipment work together to produce geotextiles that are effective.

Solution: we should have processed the coir fibre in a trash removing process and should have formed a web from coir and then the needle would have penetrated the material and the needle punch would have been successful

NEEDLE PUNCHING MACHINE

3.4 THERMAL BONDING

We switched to a thermal bonding method after realizing that needle punching had its limitations and that the hardness of coir fibers presented a problem. We melted the fibers using heat, taking advantage of the thermoplastic qualities of polypropylene, to enable a smooth bonding process with the coir fiber component. The successful implementation of this novel approach allowed us to generate the required composite material for use in geotextile applications. We successfully integrated polypropylene and coir fibers by utilizing the adaptability of thermal bonding, setting the stage for improved soil stabilization options.

FINAL OUTPUT

RESULT AND CONCLUSION

in navigating the complexities of geotextile material development for soil stabilization, our journey encountered both challenges and innovative solutions. Initially facing obstacles with traditional needle punching due to the toughness of coir fibers, we swiftly adapted our approach, embracing thermal bonding as an alternative method. Leveraging the thermoplastic nature of polypropylene, this approach allowed for seamless integration and bonding between polypropylene and coir fibers, resulting in a successful production outcome. This strategic pivot not only showcased our adaptability and problem-solving prowess but also underscored the importance of flexibility and experimentation in material engineering. By embracing new methodologies and refining our techniques, we not only overcame technical hurdles but also advanced our understanding of geotextile fabrication. Moving forward, these insights will inform our continued efforts to develop sustainable and effective solutions for soil stabilization, bolstering infrastructure resilience and environmental sustainability.

REFERENCE:

1. J. Broda *et al.*
   Application of innovative meandrically arranged geotextiles for the protection of drainage ditches in the clay ground
2. **Geotext. Geomembranes**
   (2017)
   S. Chaiyaput *et al.*
   Measured and simulated results of a Kenaf Limited Life Geosynthetics (LLGs) reinforced test embankment on soft clay
3. **Geotext. Geomembranes**
   (2014)
   N. Kumar *et al.*
   Nonwoven geotextiles from nettle and poly(lactic acid) fibers for slope stabilization using bioengineering approach
4. **Geotext. Geomembranes**
   (2018)
   K.R. Lekha
   Field instrumentation and monitoring of soil erosion in coir geotextile stabilized slopes - a case study
5. **Geotext. Geomembranes**
   (2004)
   K.R. Lekha *et al.*
   Coir geotextile reinforced clay dykes for drainage of low-lying areas
6. **Geotext. Geomembranes**
   (2006)
   A.R. Marques *et al.*

Effects of the climatic conditions of the southeastern Brazil on degradation the fibers of coir-geotextile: evaluation of mechanical and structural properties

7. **Geotext. Geomembranes**
(2014)
M. Pritchard *et al.*
Textiles in civil engineering. Part 2 – natural fibre geotextiles
A. Rawal *et al.*
Mechanical properties and damage analysis of jute/polypropylene hybrid nonwoven geotextiles
8. **Geotext. Geomembranes**
(2013)
T. Sanyal *et al.*
Application of bitumen-coated jute geotextiles in river bank-protection works in the Hooghly estuary
9. **Geotext. Geomembranes**
(1994)
P. Saha *et al.*
Durability of transesterified jute geotextiles
10. **Geotext. Geomembranes**
(2012)