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Utilization Of Geotextile for Soil Stabilization A- Review Paper

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ABSTRACT

Geotextiles, a recently developed field in civil engineering and other sectors, have a wide range of potential uses around the world. Modern pavement design and maintenance methods heavily rely on geotextiles. Their use in transportation applications in particular has increased dramatically across the board. Geotextiles are excellent building materials for projects including highways, harbours, and other types of infrastructure. They have a promising future because of their multifaceted traits.

The article includes a summary of several natural and synthetic textile fibres used to make geotextiles.

Key words- Separators, drainage, filtration, reinforcing, woven and non-woven fabrics; geotextiles; and

1.INTRODUCTION

Geotextiles, geogrids, geomembranes, erosion control blankets and materials, geosynthetic clay liners, geocomposite drainage materials, and geonets are examples of geosynthetics that are frequently utilised in the transportation sector.

One of the most adaptable and economical ground alteration products has been geotextiles. Nearly all branches of civil, geotechnical, environmental, coastal, and hydraulic engineering now use them. The other three main elements of the field of geosynthetics are geocomposites, geomembranes, and geogrids.

Geotextiles are planar polymeric materials that are widely employed in roadways for separation and reinforcement in flexible pavement systems. It helps to improve subsurface drainage by providing filtration and drainage and enables the quick dissipation of excess subgrade pore pressures brought on by traffic loading.

. The appropriate selection of textile fibre is crucial if you want geotextiles to have all these features. Nylon, polyester, and polypropylene are some of the different synthetic fibres used in geotextiles. Ramie, jute, and other natural fibres can also be utilised.

The varieties of fibres appropriate for use as geotextiles have been discussed in this work along with their fundamental properties, uses, and applications in diverse fields.

2. IMPORTANT CHARACTERISTICS OF GEOTEXTILES

The characteristics of geotextiles are broadly classified as:

1. Physical properties:

a) specific gravity
b) weight
c) thickness
d) stiffness
e) density .

2. Degradation properties:

a) biodegradation
b) hydrolytic degradation
c) photo degradation
d) chemical degradation
e) mechanical degradation
f) other degradation occurring due to attack of rodent, termite etc.

3. Endurance properties:

a) elongation
b) abrasion resistance
c) clogging length and flow etc.

3. FIBRE SELECTION FOR GEOTEXTILES

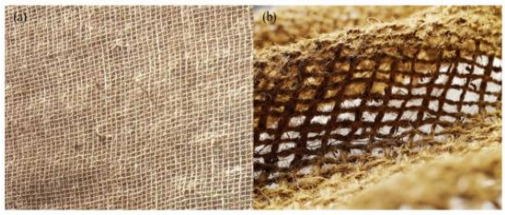
For a variety of uses, several fibres from the natural and synthetic categories can be employed as geotextiles.

3.1 Natural materials: Geotextiles are made from natural fibres like paper strips, jute nets, wood shavings, or wool

mulch. However, biodegradable natural geotextiles are made with a purposefully short lifespan in mind. They are typically employed to stop soil erosion until ground-level vegetation can be fully developed. The most popular types of natural fibres are:

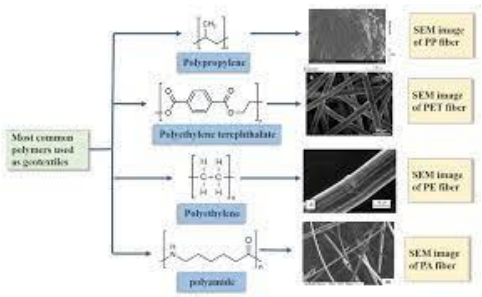
- **Ramie**

- **Jute**



3.2 Synthetic Fibers: Polyester, polyamide, polyethylene, and polypropylene are the four main synthetic polymers that are most frequently utilised as the primary raw materials for geotextiles.

- **Polyamides (PA)**
- **Polyesters (PET)**
- **Polyethylene (PE)**
- **Polypropylene (PP)**
- **Chlorine Polyethylene (CPE)**
- **Ethylene and butyl acrylate**
- **Polyvinyl chloride (PVC)**



4. GEOTEXTILES TYPES

A permeable synthetic material made of textiles is called a geotextile. Typically, polymers like polyester or polypropylene are used to create them. In addition, three main categories of geotextiles are prepared: woven fabrics, non-woven fabrics, and knitted fabrics

- **Woven Geotextiles**: These are manufactured by weaving process by the use of monofilament, multifilament and fibrillated yarns. They possess high tensile strength and mainly used for reinforcement and separation purpose. They are most commonly used along with soil in pavements in application to increase stabilization and improves road ways long term use with lower maintenance cost.

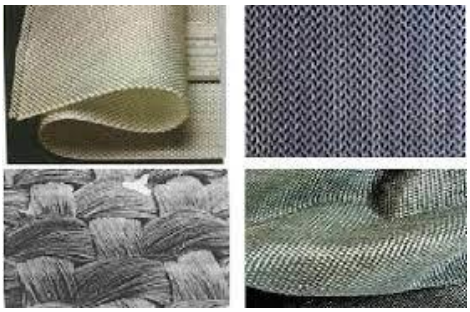


Fig 1 Woven geotextile,

Figure 2.Non-woven geotextile,

- **Non woven Geotextiles**: Nonwoven geotextiles are produced by needle punching (mechanical bonding), thermal bonding (by heat) and chemical bonding of different types of yarns of different polymers. These are light in weight and able to perform filtration and drainage functions for stabilization of soil. These are commonly used in ditches, drains and around the pipes, possess high permeability and transmittivity
- **Knitted fabrics**: Another method used in the production of knitted geosynthetics is knitting, which was originally developed for the textiles used in garments. This procedure involves weaving a number of yarn loops together. Figure depicts a knitted cloth as an example. There aren't many knitted types made. All

knitted geosynthetics are created by combining the knitting technique with another geosynthetics production technique, such as weaving.

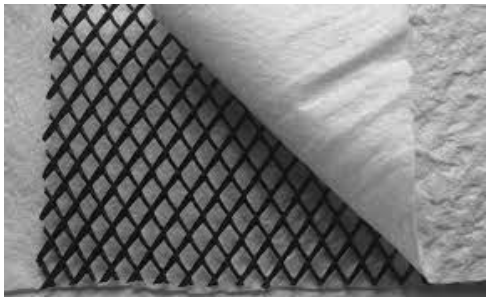


Figure 3.Knitted geotextile ,

5. GEOTEXTILES' FUNCTIONS

The geotetile functions are help in reinforcement filtration, drainage, strengthening, sealing, and protection define a geotextile's mode of operation in any application. The geotextile executes one or more of these tasks at once depending on the application.

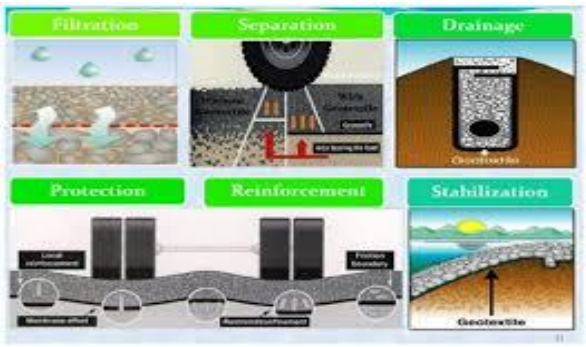


Fig. 4 shows the applications for geotextiles.

5.1 FILTRATION

Filtration is described as "the equilibrium geotextile-to-soil system that allows for appropriate liquid flow with little soil loss across the plane of the geotextile throughout a service lifespan compatible with the application under consideration" Fabrics used in filtration can be either woven or non-woven, allowing water to pass through while trapping soil particles.

The primary characteristics of geotextiles that are involved in filtration action are porosity and permeability. Application aids in the warping of geotextiles to replace graded aggregate filters. Both horizontal and vertical drains are suited for these applications. The employment of a geotextile in a pavement edge drain, as depicted in figure 6, is a frequent example of how the filtration function is demonstrated.

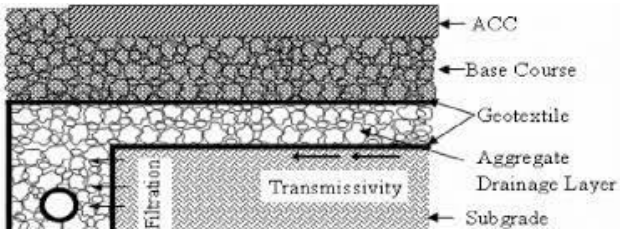


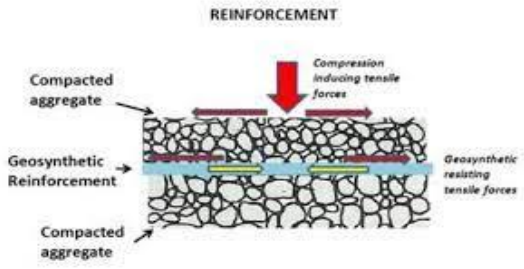
Figure 5.1 Shows the transmission and filtering functions

5.2 Reinforcement

The insertion of a geotextile into a soil results in a synergistic enhancement in the overall system strength, which was principally established through the following three mechanisms:

Lateral constraint induced by geotextile-soil/aggregate interfacial friction causing an additional, greater shear strength surface to emerge as the potential bearing surface failure plane membrane form of wheel load support.

The tensile strength of the geosynthetic material used in this process significantly increases the structural stability of the soil. This idea is comparable to using steel to reinforce concrete. Steel reinforcement is used to strengthen concrete since it is weak in tension. Similar to the reinforcing steel, geosynthetic materials work by giving strength to aid in holding the soil in place. Roads and embankments can be constructed over extremely brittle soils thanks to the reinforcement offered by geotextiles or geogrids, and steeper embankments can be developed.



5.3. Separation

Separation in transportation applications describes how the geotextile works to keep two nearby soils from interacting with one another. For instance, the geotextile maintains the

drainage and strength properties of the aggregate material by separating fine subgrade soil from the aggregates of the base course. Figure 5 shows how separation has an impact.

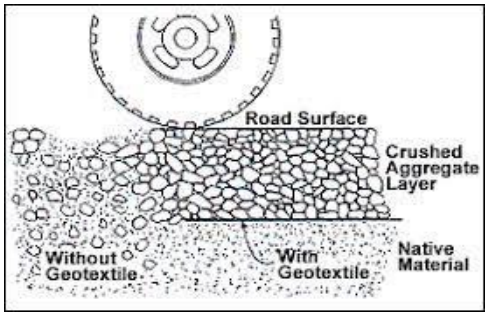


Figure 5.3 shows how separation has an impact.

Separators are used to stop the pumping effect brought on by dynamic loads and to help water flow while retaining soil particles. Thickness and permeability are the most significant defining qualities in these kinds of geotextiles. Some of the areas where this technology is used are:

Some of the areas where this technology is used are:

- Between stone base courses and land fills;
- Between the subgrade in railroads;
- Between sand drainage layers and geomembranes
- Under parking lots, curbs, parking slabs, sport and athletic fields, and sidewalk slabs.

6. TEST PERFORMED

6.1 LIQUID LIMIT

Liquid limit is significant to know the with construction. From the results of liquid limit the compression index may be estimated. The compression index value will help us in settlement analysis. If the natural moisture content of soil is closer to liquid limit, the soil can be considered as soft if the moisture content is lesser than liquids limit, the soil can be considered as soft if the moisture content is lesser than liquid limit.

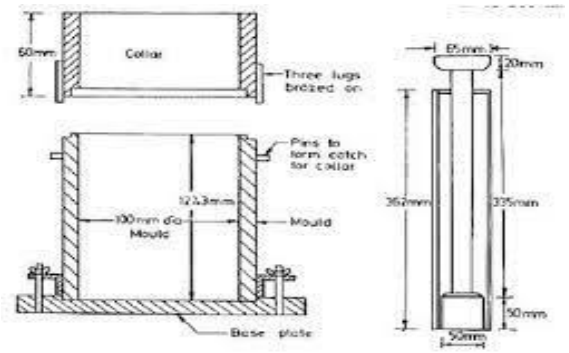
6.2 PLASTIC LIMIT

The plastic limit of a soil is the moisture content at which soil begins to behave as a plastic material. At this water content (plastic limit), the soil will crumble when rolled into threads of 3.2mm(1/8in) in diameter. In this article test methods used for determination of soil plastic limit in accordance with ASTM D4148 will be presented.

Figure 6.2 (Plastic limit)

6.2 STANDARD PROCTOR COMPACTION

Soil compaction is the process in which a stress applied to a soil causes densification as air is removed from the pores between the soil grains. It is an instantaneous process and always takes place in partially saturated soil (three phase system). The Proctor compaction test is a laboratory method of experimentally determining the optimal moisture content at which a given soil type will become most dense and achieve its maximum dry density.



6.3 CALIFORNIA BEARING RATIO (CBR) TEST

The California Bearing Ratio or CBR test is performed in construction materials laboratories to evaluate the strength of soil subgrades and base course materials. Those who design and engineer highways, airport runways and taxiways, parking lots, and other pavements rely on CBR test values when selecting pavement and base thicknesses.

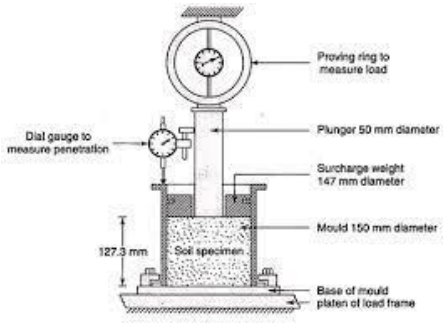


Figure 6.3 (CBR)

CONCLUSION

Textiles are used to safeguard our motherland as well as to dress the human body. It is important to spread knowledge about the use of geotextiles among the public. Geotextiles are useful tools that civil engineers can use to solve a wide range of geotechnical issues. More studies in this area are required in order to fully explore geotextile's potential.

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