Journal of Civil Engineering and Environmental Technology
p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 4, Issue 5; July-September, 2017, pp. 409-411

http://www.krishisanskriti.org/Publication.html

Geosynthetics: A Smart and Sustainable Material for Construction and Soil Improvement

Shivani Verma[1] and Vikas Kumar[2]

[1]P.G. Student, Department of Civil Engineering, Madan Mohan Malaviya University of Technology, Gorakhpur, India
[2]Department of Civil Engineering, Madan Mohan Malaviya University of Technology, Gorakhpur, India
E-mail: [1]shivanivermace0094@gmail.com, [2]vikaskumarnitk@gmail.com

Abstract—*Geosynthetic materials have been extensively used for improving the soft soil. Geosynthetics have become smart and most sustainable material for geotechnical and environment application in the whole world. The polymeric behaviour of product makes them suitable for use in ground where high level of durability is required. Geosynthetic materials solve many types of engineering problems. In this paper, we focus on the applications of geosynthetic materials and its functions for soil improvement and construction purposes. Geosynthetic materials have great potential to be used also as a cost effective solutions for several engineering problems. Geosynthetic materials are available worldwide and activity is robust and steadily growing.*

Keyword*: Geosynthetics, Woven, Non-woven, Geotextiles.*

1. INTRODUCTION

Geosynthetic materials are man-made materials used to improve soil conditions. It makes possible cost effective environmental and geotechnical engineering construction projects. The word Geosynthetic is derived from:

Geo=earth or soil+ *Synthetic*=man made

Geosynthetics are artificial fabrics which are placed on or in soil to improve or modify civil engineering works. The term GEOSYNTHETIC includes continuous fibres, staple fibres, permeable textile and impermeable membranes etc. Geosynthetics are mainly manufactured from petrochemical based polymers that are biologically inert and will not decompose from fungal action.

2. Types of Geosynthetics

There are various kind of geosynthetic materials which can be used for different purposes .Few of the geosynthetic materials are as follows:

2.1. Geotextiles

Geotextiles are defined as, "any permeable textile used with foundation soil, rock, earth or any other geotechnical engineering related material in civil engineering applications". They are mainly the most used geosynthetic material. They are generally made fibres and can classify based on the techniques of production: either woven or non woven.

2.1.1. Woven

These cloth-like fabrics are made by the regular and uniform ineterweaving of threads in two directions.

These are mainly used for soil separation, reinforcement, filteration, drainage and load distribution.

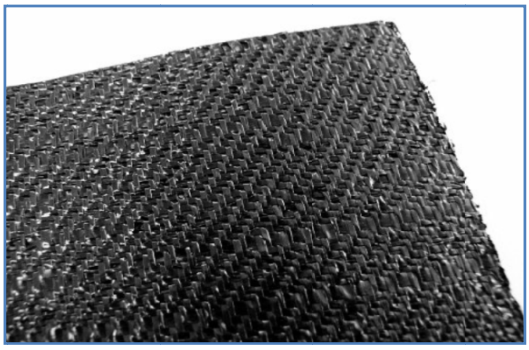

Fig 1: Woven Geotextile

2.1.2. Non-Woven

These felt like fabrics are made by a random placement of threads in a mat and bonded by heat-bonding and needle punching. Non-woven geotextiles are mainly used for soil separation, drainage, stabilization and load distribution.

Fig 2: Non-Woven Geotextile

2.2 Geogrids

Geogrids are stiff or flexible open grid like structure of integrally connected polymers with large apertures used mainly for stabilization and reinforcement of unstable soil and waste masses. Geogrids have a low strain and stretch only about 2 to 5% under load.

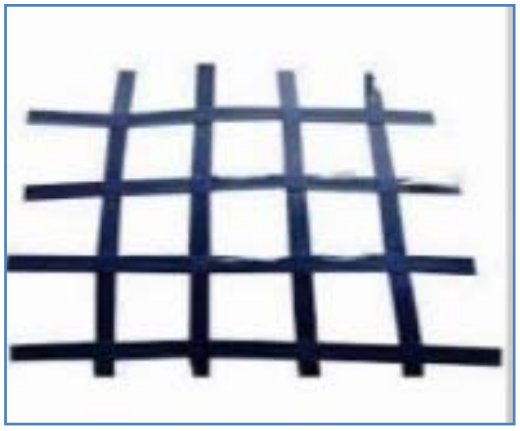

Fig 3: Geogrid

2.3. Geonets

Geonets are polymer grids with integrally fused joints and net like structures, manufactured from HDPE 0r LDPE. These are generally used in drainage application with combination of geotextiles.

Fig 4: Geonets

2.4. Geomembranes

Geomembranes are impermeable polymeric sheets generally made up of HDPE or LDPE used as barriers for solid or liquid waste containment. They are used in different applications like waste treatment projects, Water conservation projects, water transport projects and landfill projects.

Fig 5: Geomembranes

2.5. Geocells

Geocells are mainly formed from polyethylene sheets and expand out like an accordion when opened up to use. They are meant to contain soil, gravel or other fill material within their maze of cells. They are used in slopes with soft subgrades for stabilization and in erosion control in channels.

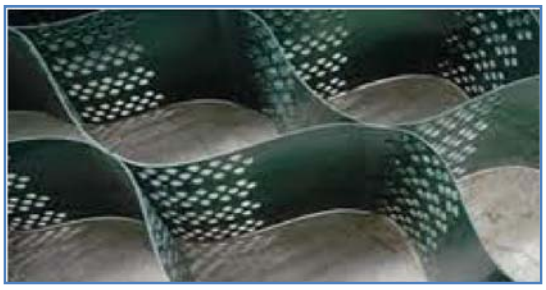

Fig 6: Geocells

6 Geosynthetic clay liners (GCL)

Geosynthetic clay liners are the combination of woven and non-woven geotextiles with Bentonite is sandwitched in between them. The bentonite swell during wet condition and this system is worked as a Clay liner. GCLs are also used as environmental protection barriers in transportation facilities or storage tanks, and as single liners for canals and ponds.

Fig 7: Geosynthetic clay liner

2.7 Geocomposites

Geocomposites are hybrid system of any, or all of the above geosynthetics types such as geotextiles, geogrids, geonets, geomembranes, geocells, geosynthetic clay liners, which can function as specifically designed for use in soil, rock and liquid related problems.

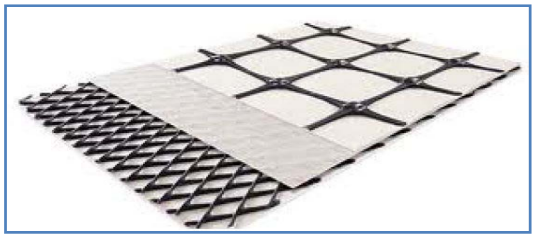

Fig 8: Geocomposites

3. Functions

Geosynthetics are generally designed for a particular application by considering the primary function that can be provided. There are 6 primary functions which geosynthetic material perform, when placed in or soil.

3.1. Separation

Geosynthetic material acts to divide two layers of soil that have dissimilar particle size distributions. For example, Geotextile materials are used to prevent road base material from penetrating into soft underlying soft subgrade soils, thus maintain roadway integrity. It also used to prevent fine-graded subgrade soils from being pumped into permeable granular road bases.

3.2. Erosion Control

Erosion is a natural phenomenon that can not be ignored. However, its impacts can be reduced by taking suitable methods. One such effective and economical method is use of geosynthetics for the control of erosion. Geosynthetic materials act to minimize soil erosion due to surface water runoff and heavy rainfall influence. Geosynthetic material can be used for short term or long term erosion control measure along side slopes. For example, Geotextiles are used for temporary protection against erosion on newly seeded slopes. After the slope has been seeded, the geotextile is anchored to the slope holding the soil and seed in place until the seeds germinate and vegetative cover is established.

3.3. Filteration

Geosynthetics act as a filter, it permits liquid to flow through the soil while preventing most of the soil particles from being carried away by the current.

3.4. Drainage

Geosynthetic material act as a drain to carry fluid flows through less permeable soils. Geotextiles will efficiently collect superfluous water from structures, such as rainwater or surplus water, from the soil and discharge it. Geosynthetic materials have also been used as prefabricated vertical drains (PVDs) and slope interceptor drains.

3.5. Reinforcement

Geosynthetic with high tensile strength perform the function of reinforcement. Geogrids are used to add tensile strength to a soil mass in order to produce vertical or near vertical changes in grade. Heavy geotextiles can be used to reinforce earth structures by means of fill materials due to their high tensile strength.

3.6. Barrier

Geosynthetic acts as an impermeable barrier to fluids or gases. For example, geosynthetic clay liners, thin film geotextile composites. Geomembranes are used as barrier to prevent flow of liquid or gas.

4. Conclusion

Geosynthetics are considered as bona fide engineering material that not only are filling in for the scarce raw materials like cement and steel, but also are turning out to be a pretty sound good alternative to the conventional designs. Geosynthetic material has been used in number of applications and currently used in civil, geotechnical, hydraulic, transportation and private development applications including roads, airfields, railroads, reservoir and retaining structures and also in environmental projects. Overall, the use of geosynthetic material has led to major advances towards the construction environment systems that are cost effective but provide enhanced environmental as well as constructional protection.

REFERENCES

[1] Mena I. Souliman and Claudia Zapata, 2011. Worldwide applications of geosynthetics reinforced walls for soil reinforcement. Jordan Journal Of Civil Engineering, Volume 5, No. 1, 2011.

[2] Tarun kumar, Geosynthetics materials: recent advancements for ground improvements, International Journal Of Research and Development Organisation.

[3] A. Bouazza, Geosynthetic clay liners, Geotextiles and Geomembranes, Volume 20, Issue 1, February 2002.

[4] Anoop Singh, Geosynthetics materials and applications for soil reinforcement and environmental protection works, International Journal of Emerging Research in Management and Technology, ISSN:2278-9359 (Volume-2, Issue-5).

[5] G. Madhavi Latha, Vidya S. Murthy, Effects of reinforcement form on the behaviour of geosynthetic reinforced sand, Geotextiles and Geomembranes 25 (2007) 23-32.

[6] www.aquatan.com