APPLICATION OF NATURAL FIBERS IN EROSION CONTROL

Ibrahim ,G.,E., and Mahmoud, E.,R.,

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Abstract

The erosion of river banks ,canals or shore lines of sea is a common phenomenon of transportation of soil particles by exogenous wind or water action .The erosion phenomenon starts as soon as the first particle ,detached from the rest of the soil ,gets carried away due to the impact of splash and velocity of flow , but it only became a serious problem in recent centuries because of the a accelerated erosion which caused severe instability and even destruction of the slope .

Before usage of geotextiles ,the conventional method of river bank protection against erosion envisaged laying of a permeable multi –layer granular overlay on the eroded surface with armours on top, such as riprap ,concrete blocks and concrete slabs . But even when properly installed ,granular filters are washed away ,under the erosive forces ,leaving the soil slope unprotected .

A geotextile placed between the rock layer and the underlying soil surface provide anchorage of the underlying soil and protects it from erosion and wave attack . Beside this ,these aggregate filters are considerably thicker than geotextile sheets ,often by a factor of 500 to 1 .

Geotextiles are permeable textiles structures used in civil engineering applications in conjunction with soil , rock or other technical materials for improving the engineering performance of the engineering works . The main functions geotextiles provide are aggregate separation ,soil ,reinforcement ,filtration, drainage ,and moisture or liquid barriers .

In erosion control applications ,the primary function of geotextile is as a filter by allowing free liquid flow through its plane and by retaining soil particles on the upstream side .

Eco-friendly fibers and fabrics are gradually gaining importance in recent times due to environmentalist movement through out the world. Biobased geotextiles are used for short term (6 months to 10 years) applications where biodegradability is a positive attribute ,such as erosion control and mulching ,and is know as soil bioengineering .Fiber options for biobased geotextiles include cereal straws, coir ,jute , kenaf ,flax ,sisal ,hemp, cotton and others , due to their better performance ,ease of installation ,availability of materials ,and they are environmentally sound.

It was found that ,the surface erosion can be effectively prevented with a proper vegetation cover on such land ,as biodegradable geotextiles initially provides protection to retain the seeds until germination and developing roots deep into the soil , and over time ,the geotextile will decay and add organic matter to soil which helps in speedy growth of plants .

Woven fabrics are considered the most suitable construction technique in soil stabilization and erosion control ,due to their desirable properties such as porosity ,strength and elongation .In general a woven geotextile is less likely to stretch and does not let water to flow as freely as nonwoven geotextiles .

The experimental work

There are no previous studies about using natural fabrics in erosion control , this research concerns with producing fabrics suitable for erosion control using natural fibers, which are cotton yarns of 10 ,14 and 20 English count and jute yarns of 9 and 12 Libra . Four different woven structures were also used in this research to produce all samples, twill weave 2/1, twill weave 2/2, irregular hopsack 2/1 and plain weave 1/1.

Results and Discussion

Through this research, it was reached to the following results

Water permeability

Jute samples

It is clear from the diagrams that there is an inverse relationship between number of picks per cm and water permeability, this is due to that the increasing in number picks per unit area cause the fabric to be more compacted so water permeability will be decreased .

It can also be observed from the diagrams that samples produced with 9 Libra have achieved the highest rates of water permeability, whereas samples produced of 12 Libra have achieved the lowest rates. we can report that the more diameter the yarns get the less porosity the fabric become because of the decreasing in spaces between yarns, so the water permeability will be decreased.

Cotton samples

It is clear from the tables , that there is an inverse relationship between number of picks per cm and water permeability, this is due to that the increasing in picks per unit area cause the fabric to be more compacted so water permeability will be decreased .

It is also clear from the figures that plain weave samples have recorded the highest rates of water permeability compared to twill weave samples but difference was insignificant . We can state that plain weave has intersection per unit area than twill weave ,which increasing spaces between yarns leading to the increase in permeability .

U.V resistance test

Jute samples

It can be seen from tables of jute samples that there is an inverse relationship between number of picks and U.V resistance. We can state that the more picks /cm the more compacted the fabric become which cause decreasing in U.V permeability leading to the increase in its resistance to U.V effect .

We can also notice from the diagrams of jute samples that samples of 12 Libra have scored the highest rates of U.V resistance followed by 9 Libra samples . This is due to the 12 Libra yarns are thicker in diameter than 9 Libra .so they obstruct the passage of U.V rays more than 9 Libra yarns leading to the increase in its U.V resistance

It is also clear from the diagrams that twill weave structure has achieved the highest rates of U.V resistance , whereas irregular hopsack structure has achieved the lowest rates . We can report that the twill weave structure has the ability of being more compacted than irregular hopsack because of the distribution of the intersection.

It is clear from tables that all cotton samples have scored an excellent results when exposed to U.V radiation for 100 hours .