Application of Geosynthetics Material in Canal Lining

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Abstract- *The aim of the paper is to define a soil and according to soil measure the seepage control in canal lining by using different Geosynthetics material like Geotextle and Geomembrane in a different layer. According to the test results the soil is defined well graded clayey soil. Geosynthetic and Geofibre (50 GSM) material used from the study have been brought from Construction Chemical Corporation Pune for the testing. Permability test has been performed with Geosynthetics and Geotexlite materials to find the seepage loss from the canal lining. The value of Permeability (k) has been improved 14.43 % by using single layer at centre of Geomembrane and 50.98% by using two layer of Geomembrane. Similarly Permeability (k) has been improved 14.06% by using single layer of Geotextile and 26.49% by using two layer Geotextile.*

I. INTRODUCTION

Canal irrigation in India is one of the principal methods used for improving the growth of crops. After, wells and tube wells, canal irrigation is the second largest source of irrigation especially in the plain areas of northern India, valleys of Indian peninsular plateaus, coastal lowlands etc. Understanding the importance of canal structures its lining is equally important to achieve high efficiency of canal functioning. Unlined canals always stand at the risk of loss of water due to seepage, side erosions and failures and canal getting obstructed etc kind of issues and there comes the importance of lining of canals. Geosynthetics have been used as water canal liners to control seepage since the 1950's and are an effective alternative to more traditional lining methods, such as concrete and compacted soil. One of the first uses of a Geosynthetics for a water canal was in 1954 for a U.S. Bureau of Reclamation (USBR) irrigation canal near Fort Collins, Colorado.

II. EXPERIMENTAL PROGRAM

The soil used in the present investigation was collected from **Talegaon area of Pune**. The properties of soil are as under.
Liquid limit=40% Plastic Limit=18
Shrinkage limit=15 Free swell=40

In the soil sample Geosynthetic materials (Geomembrane and Geotextile) are used for calculating the Permeability of soil.
The mix specifications are as under.

(a)S0G- Soil with no layer of Geosynthetic material.
(b)S1GM- Soil with one layer of Geomembrane material.
(c)S2GM- Soil with two layer of Geomembrane material.
(d)S1GS- Soil with one layer of Geotextile material.
(e)S2GS-Soil with two layer of Geotextile material.

Observation Table –

Test No-01-S0G

Reference Point	Height Above Datum (h_1)(cm)	Height Above outlet (h_2)(cm)	Time (t) min.	Height ratio
1	50	49.5	1	1.01
2	49.5	49.2	1	1.006
3	49.2	49.0	1	1.004
4	49.0	48.7	1	1.006

Test No.-02-S1GM

Reference Point	Height Above Datum (h_1)(cm)	Height Above outlet (h_2)(cm)	Time (t) min.	Height ratio
1	50	49.6	1	1.008
2	49.6	49.3	1	1.006
3	49.3	49.1	1	1.004
4	49.1	48.9	1	1.004

Test No.-03-S2GM

Reference Point	Height Above Datum (h_1)(cm)	Height Above outlet (h_2)(cm)	Time (t) min.	Height ratio
1	50	49.7	1	1.006
2	49.7	49.5	1	1.004
3	49.5	49.4	1	1.002
4	49.4	49.3	1	1.002

Test No.-04-S1GS

Reference Point	Height Above Datum (h_1)(cm)	Height Above outlet (h_2)(cm)	Time (t) min.	Height ratio
1	50	49.7	1	1.006
2	49.7	49.4	1	1.006
3	49.4	49.2	1	1.004
4	49.2	49.0	1	1.004

Test No.-05-S2GS

Reference Point	Height Above Datum (h_1)(cm)	Height Above outlet (h_2)(cm)	Time (t) min.	Height ratio
1	50	49.6	1	1.008
2	49.6	49.4	1	1.004
3	49.4	49.2	1	1.004
4	49.2	49.0	1	1.004

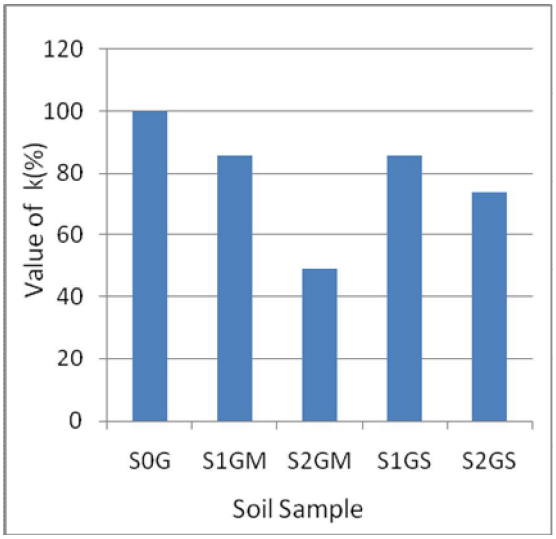
Permeability (k) =

$k = (2.303 \times a \times L/1000 \times A \times 60 \times t) \times \log_{10}(h_1/h_2)$

$a = 28.27mm^2$, $L = 110mm$ $A = 7853mm^2$,

$t = 1min.$

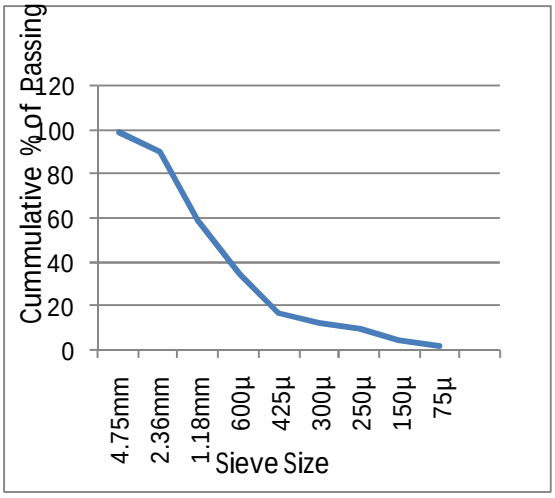
Soil Sample	Value of k (Permeability)
S0G	3.5846×10^{-4}
S1GM	3.0729×10^{-4}
S2GM	1.7575×10^{-4}
S1GS	3.0809×10^{-4}
S2GS	2.6351×10^{-4}



Sieve Analysis

Soil Sample-1kg

Sieve Designation (IS)	Mass of soil retained (gms)	% mass retained	Cumulative % passing
4.75mm	10	1%	99%
2.36mm	90	9%	90%
1,18mm	320	32%	58%
600	230	23%	35%
425	180	18%	17%
300	40	4%	13%
250	30	3%	10%
150	50	5%	5%
75	30	3%	2%
Pan	20	2%	0%



III. CONCLUSION

From the series of tests conducted on soil sample using with Geosynthetic material (Geomembrane and Geotextile), the following conclusion are drawn.

1) From the test results it can be concluded that the using of Geosynthetic material to well graded clayey soil decrease its permeability and increase the water carrying capacity of soil.
2) The Permeability of soil is considerably reduced while using two layer of Geosynthetic material.
   a) When using two layer of Geomembrane material the permeability of soil is decrease upto 49.02% .
   b) When using two layer of Geotextile material the permeability of soil is decrease upto 73.51%.

REFERENCES

[1] Swihart, J.J., and Haynes, J.A. (2002). Deschutes - Canal-Lining Demonstration Project, Year 10 Final Report, R-02-03, Bureau of Reclamation, November.
[2] Sarsby, R.W. (Eds), 'Geosynthetic in civil engineering', Woodhead Publishing Limited, 286 pp.
[3] Venkatappa Rao G., 'Geosynthetic and Introduction Sai Master Geoenvironmental Service Pvt. Ltd. 325pp
[4] Prof. T.N. Ramamurthy, Prof. T.G. Sitharam, 'Geotechinacial Engineering' (Soil Mechanics)