Dewatering of Soft Marine Clays by using Electrokinetic Geosynthetics

R.Venkatakrishniah, P. Dayakar, K. Venkat Raman

Abstract*: Marine earth is found along the beach front areas of the world. This kind of dirt having uncommon properties like low shear quality and high compressibility. It was discovered that electrokinetic treatment is viable instrument in expanding the quality and expelling the pore water from mud. Electrokinetic geosynthetics (EKG) are recently created material which go about as terminals that readied by joining the electrokinetic marvels with elements of geosynthetics. The target of the work is to think about the dewatering effectiveness of EKG as cathode in marine dirt and the undrained shear quality. The different parameters contemplated are voltage(6V ,12V) and distinctive number of electrodes(1 anode and 2 anode with 10 cm spacing).The undrained shear quality of soil tests were considered when the treatment. The variety of current and opposition is additionally considered.

Keywords – Compressibility, electro kinetic treatment

I. INTRODUCTION

Delicate soil like marine earth having high water content brings about releasing of soil particles holding, low bearing limit, low shear quality and high compressibility. Building development is troublesome in delicate soils without changing the qualities[1]-[3]. Dewatering by electrokinetic process is discovered successful in lessening the high water content.

In geo technical application electrokinetic treatment is applied in soil with low penetrability, high pore water and fine grained soils. Electrokinetic treatment is finished by applying electric flow through cathodes.

A. Electro-Osmosis Theory

Electro-assimilation is where stream of water between the dirt particles is initiated under an applied direct ebb and flow electric field. Electro-assimilation based soil improvement is reasonable for dirt which having net surface negative charge under an applied electric field anions are pulled in towards the anode while cations are pulled in towards cathode[4]-[6].

Customary geosynthetics are utilized in designing fields to do capacities like waste, support, filtration, partition, embodiment and sorption. Elecrokinetic geosynthetics(EKG) perform work like dewatering, reinforcing, molding in materials like soil, mucks, slurries, tailings fertilizer. Elecrokinetic geosynthetics have the ability to impact the development of water in soil by electrokinetic implies.

Geosynthetics are principally polymer based material. It very well may be made single or structure blends of woven, non-woven, needle punched, weaved, expelled, or covered materials. Elecrokinetic geosynthetics are framed by incorporation of leading elements within or associated with standard geosynthetic material[7]-[10].

In this examination, Elecrokinetic geosynthetics is utilized as cathode, by framing the geosynthetics as terminals. Elecrokinetic geosynthetics beat the issue of evacuating water by using the waste elements of geosynthetics with the extra favorable position of abusing geosynthetics in electrokinetic implies[11]-[13]. A large portion of Elecrokinetic geosynthetics are having double works at first in dynamic mode which might be of brief span and which is trailed by long haul detached job. In this paper, an investigation of dewatering of marine mud utilizing Galvanized iron (GI) and electrokinetic geosynthetics (EKG) as terminals were utilized.

II. METHODOLOGY

A. Soil

Soil is collected from Chennai Port area whose relative properties are shown in Table 1.

Properties	Values
Specific gravity	2.4
Organic matter content (%)	2.7
Liquid limit (%)	82
Plastic limit (%)	28.5
Plasticity index (%)	53.5
Shrinkage limit (%)	9
Percentage of clay (%)	39.5
Percentage of silt (%)	40.5
Percentage of sand (%)	20
Optimum moisture content OMC (%)	31
Maximum dry density(g/cc)	1.3
IS soil classification	MH
Undrained shear strength(kN/m^2)	3.3
Natural moisture content (%)	79

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B. Test Tanks

The test tank having dimension 40 cm x 40 cm x 50 cm height made of glass of 10 mm thickness. Holes are provided at the bottom of tank at a spacing of 5cm[14]-[16].

C. Methods

Water authority plate is given a good ways off of 10 cm underneath the tank during the procedure. Conductive geosynthetics was set on base of tank. GI cathode is set a ways off of 5 cm from the base of tank to go about as anode, subsequent to filling the tank with soil with its normal water content .The terminals were then associated utilizing standard adaptable copper wire to a DC unit. Two voltages 6 V and 12 V are applied for the examination for term of 3 hours.

Figure.1 shows the schematic chart of dewatering set up. After the treatment the undrained shear quality from 5 cm and 15 cm from anode is resolved[17]-[20].

Figure.1.experimental setup

D. Arrangements of Anode

Figure 2 shows the arrangement of anode during the treatment. (a) 1 Anode at the center of tank and (b) 2 Anode at a spacing of 10cm[21]-[24].

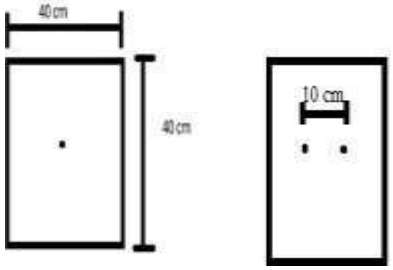


Figure.2.Arrangement of anodes

III. RESULTS AND DISCUSSIONS

Cumulative volume of water collected at cathode Figure 3 and Figure 4 shows the cumulative volume of water collected at cathode. As the voltage increases the cumulative volume of water collected also increases. The graph shows the cumulative volume of water increases with voltage and more number of anodes[25]-[30]

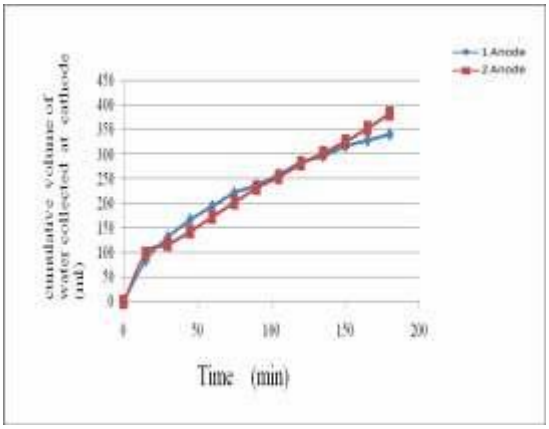
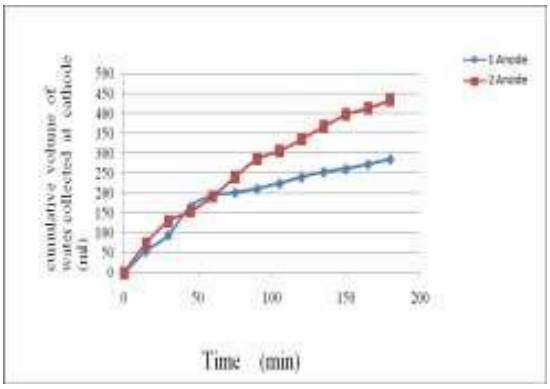


Figure.3.Cumulative volume of water collected at cathode- 6 v



A. Figure.4.Cumulative volume of water collected at cathode- 12v

A. **Variation of current with time**

Figure 5 and Figure 6 shows the variation of current with time. Current goes on decreases with time. This is due to the decrease in water content[31]-[32].

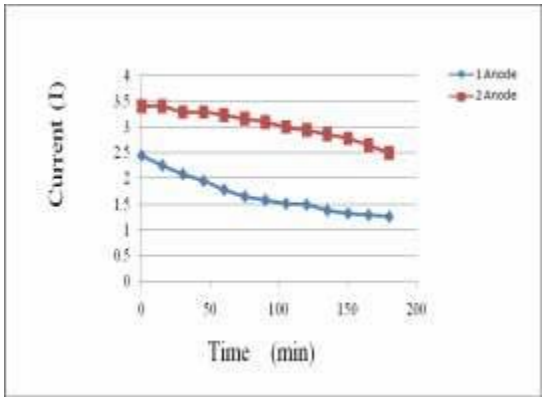


Figure.5.Effect of current with time - 6 v

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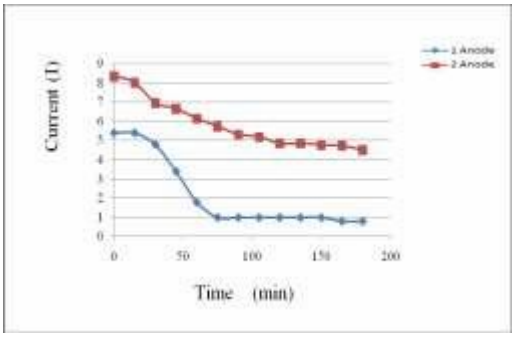

Figure.6.Effect of current with time - 12 v

B. Variation of resistance with time

Figure 7 and Figure 8 shows the effect of resistance with time. The resistance of soil goes on increases with time

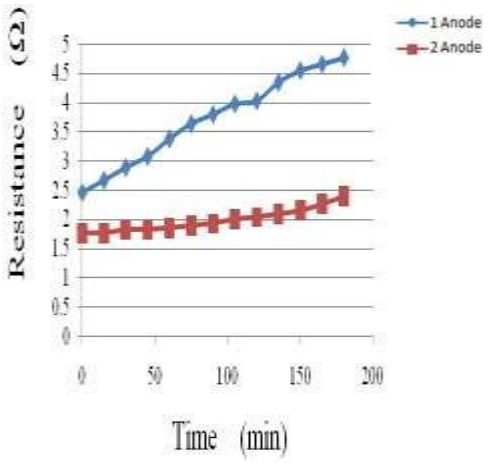

Figure.7.Effect of resistance with time -6 v

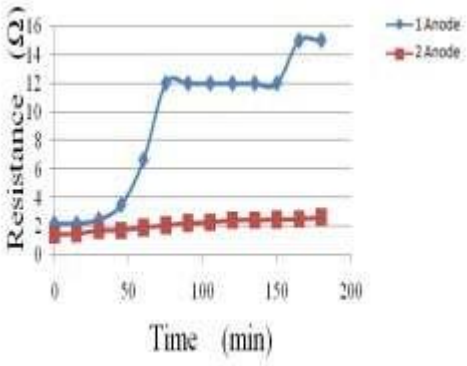

Figure.8.Effect of resistance with time - 12 v

C. Undrained shear strength

Figure 9 shows the undrained shear strength of clay before and after the treatment. The vane shear strength of soil found to be increased in 5 cm than 15 cm from anode .The strength of soil increases the area near anode.

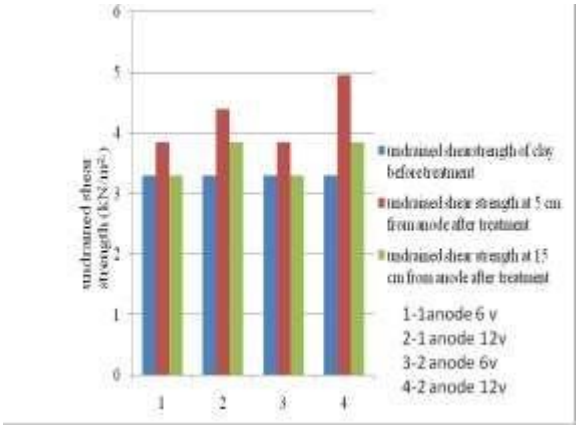

Figure.9.undrained shear strength

IV. CONCLUSION

From the results presented in this paper electro kinetic geosynthetics are suitable technology for dewatering. The soil near the anode drained out and undrained shear strength of soil near the anode increases and the material become drier. In this study conductive geomembrane is used as cathode using conductors ie, stainless steel mesh[33]-[34]. Geomembrane have functions like filtration, separation, drainage etc. Therefore no filtering units like filter paper is used in this study for filtering the water from clay. The strength of clay is noted after end of treatment and there is increase in strength of soil near the anode. The increase in voltage and number of anodes increase the dewatering process and undrained shear strength of soil. Electro kinetic process decreases the water content near the anode and it is found to be effective tool to remove water from marine clay. The efficiency of process can increase by increasing parameter like time, voltage.

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