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Review on Stabilization of Soil Using Polyacrylamide (PAM) Polymer and its Application in Civil Engineering

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ABSTRACT

The primary purpose of this study is to explore the utility of polyacrylamide (PAM) in geotechnical applications and to assess the impact of polyacrylamide on soil. Polymer which is employed for soil stabilization should be of low-cost and readily accessible. In soil stabilization, the poor quality of soil is converted into an important engineering material. The soil stabilization improves the strength of the soil, also increases its bearing capacity. The CBR test was conducted on two sample i.e. on untreated sample and PAM mixed soil sample. The outcome achieved are matched between two samples and the impact of polyacrylamide on soil index properties and desirability in construction of flexible pavement.

Keyword : Polyacrylamide (PAM), stabilisation, soil

I. INTRODUCTION

In this quaternary time, growing population has been an excellent problem for creatingresources available. thanks to which cities or town are expandingtheir areas where the land comprises low soil quality. Construction workcan't be administered in such sort of land. Therefore, it becomes necessaryto enhance the standard of soil. As per engineering aspect, method to enhance soil is termed as STABILISATION. In technical terms, the method of improving soil properties by various methods with a view that the improved soil can sustain the load of whole structure is SOIL STABILISATION. The aim of this project is to stabilize the soil by using Polyacrylamide (PAM). it's high relative molecular mass water soluble or swellable polymers formed from acrylamide or its derivatives. Polyacrylamide a non-ionic, water soluble, and biocompatible polymer which will be tailored to satisfy a broad range of applications. Increment the viscosity of water and encourages the flocculation of particles present in water.

II. OBJECTIVE

a) To increase the strength.
b) To study the various research done experimentally and practically.
c) To use the result obtained for stabilizing soil on selected site and preparing the flexible pavement.

III. LITERATURE REVIEW

Romel N. Georgees, Rayyan A Hassan, Robert P. Evans, Piratheepan Jegatheesan(1) In this project we found that polymeric-based additives have been used in the Stabilization of unsealed pavements as well as granular materials of select fills and sub grade for sealed pavements to enhance performance properties.

To design build and maintain infrastructures within the conservative funds available. This is additionally to balancing the increasing demand of high-performance roads on one hand, and therefore the refore the increasing social awareness of associated environmental impacts and the preservation of scarce natural resources on the other hand.

Polymeric-based additives have been used in the stabilization of un-sealed pavements as well as granular materials of select fills and sub-grade for sealed pavements to enhance performance properties. However only a few studies are administered to assess the feasibility of using PAM stabilized granular materials in pavement structural layers. The study reported here in is to evaluate the suitability of using PAM – treated granular materials that are currently use in wearing courses of unsealed pavements in sub base layers of sealed low volume road pavements. To achieve the aim of study, a laboratory experimental program was undertaken to assess the changes in stiffness and durability characteristics of pavement materials when treated with an off the shelf synthetic polyacrylamide-based stabilizing additives. The tests performed included repeated load tri axial test (RLT), capillary rise and abrasion tests. The outcomes of this will contribute to improving the knowledge regarding the behaviour of PAM-treated materials within a pavement structure and help promote the reliability of those sustainable materials for wider adoption by road authorities

V.STEVEN GREEN AND D.E. STOTT(2) The objective of this paper mainly focuses on presenting an summary of PAM use and application. It contains variety of the recent findings in PAM work and specialize in PAM use in furrow irrigation, rain-fed irrigation or sprinkler irrigation and disturbed lands including construction of buildings, roads etc. Soil degradation could also be a big problem throughout the earth. Use of soil amendments, including anionic polyacrylamide (PAM), is one of many options for shielding soil resources. Polyacrylamide are often utilized in furrow irrigation where it reduces erosion and runoff while improving soil and water quality and water-use and rain-fed agriculture and sprinkler irrigation, PAM is used to reduce surface sealing and crusting also as erosion polyacrylamide is additionally used to stabilize steep slopes in construction, highway cuts, and other disturbed soils. Polyacrylamide is extremely cost effective in furrow irrigation systems where it is often applied at low rates through the irrigation water. In construction applications, PAM reduces labor and materials costs. As a soil conditioner, PAM is another tool that efficiency. Polyacrylamide is often cost effective it is often used to manage our soil resources.

Soil physical properties greatly affect how the soil will function within the sector. For agricultural uses, soil with excellent infiltration and stable aggregation is imperative. As infiltration decreases, runoff and erosion increase, thus with high aggregate stability helps maintain adequate space for infiltration. Soil crusting, surface sealing and therefore the compaction can inhibit seedling emergence. Additionally, the impact of the rain and therefore the rapid wetting of the soil cause slaking, disrupting the integrity of the soil aggregate. Once the soil aggregate has dispersed into smaller particles, the small particles can clog the pore spaces of the soil matrix. When this happens, a thin hardened surface is degrading the soil.

Masoumeh mokhtari and masoud dehghani(3) The serious problem on structure is expansion of soil occurring in arid and semi-arid climate regions of the world. Such type of soils swells when given an access to water and shrink when they dry out. The number of attempts is being made to control the swell-shrink behavior of these soils. The swelling potential of the

expensive soil mainly depends upon the properties of soil and environmental factors and stress conditions. Some investigators studied the swelling characteristics of expansive soil after repeatedly wetting-drying cycles. Chen et al (1985), Chen and Ma (1987), Subba Rao and Satyadas (1987), Dif and Bluemel (1991) they carry out that when soils where subjected to full swell.

R.**D. Lentz & R.E. Sojka(4)** Furrow irrigation-induced erosion could also be a significant threat to sustainable irrigated agriculture globally. Those treatments that applied a minimum of 0.7 kg ha' PAM (mean 13kg ha-1) reduced furrow sediment loss 94% (range 80-99%) and increased net infiltration by 15% (range:-8.57%). Ones of the foremost effective treatments applied PAM applied PAM at 10g m-3 in irrigation inflows during furrows during the furrow advance period. The initial high load treatment was nearly twice as effective as continuous 0.25g in 3 PAM application on these soils when slopes were 1-2%. The initial high load treatment protected furrows with slopes ranging from 0.5 to 0.35%.

Use of more advance polyacrylamide (PAM) polymers was not initiated until the last decade. PAM formulations with a wider range of molecular weights charge types, and densities are now available for agricultural uses. They are more effective, less expansive and more convenient to use that early polymers (Wallace.A. and Wallace 1986). when applied to the soil surface as a solution, PAM is readily and irreversibly absorbed to soil particles hence, main effect occurs within 1-5cm depth (Mitchell 19860 and perhaps even closer. Most of the applied PAM is apparently bound to external surfaces of soil aggregates (Malik and Leyte 1991), physical properties of PAM-treated soils differ from their untreated countermarks.

M. Malik & J. letey(5) Adsorption isotherms were determined by batch technique for six trillium labeled polymers on three soils, one of which was pretreated to create a high exchangeable sodium percentage. Three anionic polyacrylamide compounds (gaur) had a higher positive charge (T-4141), a lower positive charge (CP-14), and negative charge. Adsorption of CP -14, 21J, and T-4246 was measured on Mont-morillontic clay extracted from one soil and a specimen sample of montomorillonite clay. Adsorption of a given polymer on the low ESP soils was not significantly different, but was significantly higher on high ESP soil. The adsorption isotherms were T-4141 21J >CP14 40J 22J> T-4246 and adsorption on sand was only little less than on soil. The adsorption on clay was CP-14 T-4246 22J. The data suggest that the PAM and gaur polymers studied do not penetrate the aggregates because adsorption was approximately the same for all soils for similar aggregates sizes. Molecular sizes. Molecular confirmation and electrostatic charge each significantly affected the adsorption isotherms SYNTHETIC POLYMERS have remarkable capabilities for stabilizing soils aggregates for precisely or during a mixing process (Gardner, 1972). The early research reviewed by Gardner generally involved applying the polymers as a dry powder, mixing, moistening the soil and tiling the soil to form desirable sized-aggregates. The treatment procedure was cumbersome, usually involved applying high concentration of polymers and, therefore was not economically feasible. Another approach is to apply soluble polymers with irrigation water to stabilize existing soil aggregate. Helilia and letey (1988), Ben hur and letey (1989) and en-hur et al (1989) found the solution concretra's 10 mg L of polymers was effective in maintaining high infiltration rate under laboratory rainfall stimulator conditions. The beneficial effects of polymer treatment were marginal in successive post-treatment rain events. Theng (1979)

reported that a fairly accurate prediction is possible about the mode of bonding and orientation of short chain organic molecules adsorbed to the clay soil. The more recent development of synthetic polymers with molecular weight of 10 to 15 million g mol-create additional variables to be studied.

IV. CONCLUSION

Based on the experimental investigations on stabilization of soil we conclude that the sub – base strength of the agricultural roads is increased by addition of PAM within the soil. By practically adopting this proportion of polymer within the soil within the construction of rural road techniques subsequent results are often obtained. thanks to this the development activity cost of the agricultural construction are going to be reduced with the increased life.

Hence, we conclude that the soil mixed with 0.02% by dry weight of the soil are often used as an honest subgrade stabilization agent, to reinforce the performance of the flexible pavement, which may be beneficial within the formation of rural roads.

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