Effect of Salinity on Properties of Clay- A Review

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***Abstract*— The effect of salinity in coastal region is a predominant factor in the environment. It not only affect the air and water but also the soil.The percolation of sea water in the ground affects the various geotechnical properties of the clay located in the coastal areas. Surface cracks and shrinkage in clay affects its geotechnical properties in various ways. Cracks formed will create zones of weakness and also create a path of flow thereby increasing the permeability, compressibility, and the settlement of structures.This study deals with the effect of salinity of groundwater on some properties of clayey soil.**

Keywords—Salinity, Surface cracks.

I. INTRODUCTION

At present, as economy develops rapidly and industrialization pushes on world, soil pollution is getting more and more serious. Major sources which cause ground contamination can be of disposal of oil field brines, hazardous chemical waste, land fill leaching, sea water intrusion, surface impoundments etc. All type contamination have direct or indirect effect on various soil properties. Modification of soil properties can lead to several geotechnical engineering problems such as landslides, ground subsidence and settlement, structural instability of substructures, corrosion and durability of foundation problems. The effect of adding saline water to cohesive soil has been studied extensively by several researchers on the basis of experimental results . Due to sea water intrusion in seashore areas, the soil gets affected and causing disturbances in construction of superstructure and forming soil salinization. Soil salinization is the method in which free salts are accumulated in soil which leads to the degradation of soil and vegetation. The extent of modification not only depends on nature of contaminant but also the type of soil such as the chemical composition, physical nature and mineralogical properties. The Soil - Salinity interactions changes the soil behaviour and also leads to various geotechnical problems. The change in geotechnical behaviour of soil is mainly due to types of cations in saline water and types of clay mineral in soil layers.

II. LITERATURE REVIEW

Effect of salt concentration on desiccation cracking behaviour of GMZ bentonite was studied by Zhang et al (2017). Studies shows that water evaporation rate is strongly affected by the salt concentration of the pore water. Higher salt concentrations result in lower evaporation rates. During desiccating most of cracks appeared at the steady evaporation stage. The cracking morphology and patterns were greatly affected by the salt concentration of the pore water and larger crack lengths and lower crack densities were obtained as the initial salinity was increased.[5]

Study on Porewater salinity effect on flocculation and desiccation cracking behaviour of kaolin and bentonite considering working condition was conducted by Zhang et al (2019). Flocculation of kaolin occurs in both distilled water and NaCl solution whereas the fine particles in bentonite disperse in distilled water but aggregate in saline water. The dielectric constant of NaCl solutions decreases with an increasing Nacl concentration. The diffuse double layer thickness of pure clays will decrease with increasing pore water salinity.[4]

Effect of salinity on rheological and strength properties of cement-stabilized clay minerals by Yin et al (2019). Specimens with different porewater salinities were prepared by mixing the air dried clays with sodium chloride at various salt concentrations. Atterberg limit test results indicated that liquid limit and plasticity index of montmorillonite decreases significantly with increasing salinity.[3]

Study on Salinity effects on soil shrinkage characteristic curves of fine-grained geomaterials by Mishra et al (2019). Investigation evaluates the volume changes and accompanying densification from a saturated slurry state to a constant volume state of a reference fine grained geomaterial kaolin subjected to evaporative dewatering. Thickness of the DDL reduces with increase in ionic concentration of the pore fluid. Specimens with high pore fluid concentrations led to appearance of flocculated salt clusters on their exposed surface at low moisture contents during the final stages of drying[2]

Effects of organic matter and salinity on the flocculation of kaolinities in a settling column was studied by Li et al (2021). Experiments are carried out to evaluate the flocculation and the settling of the kaolinite in cases of various organic matter and salinity solutions in quiescent waters. The salinity and the organic matter content in the water body increase, the floc size increases rapidly. [1]

III. CONCLUSION

- The cracking morphology and patterns were greatly affected by the salt concentration of the pore water; and larger crack lengths lower crack densities were obtained as the initial salinity was increased.
- Liquid limit and plasticity index decrease slightly with increasing salinity for Kaolinite and illite, while a significant reduction can be found for montmorillonite.
- Presence of sodium chloride decreases the Atterberg limits and viscosity parameters and increases the flowability of groups of clays illite, kaolinite and montmorillonite.

- Settling velocity deceases faster in the fresh water as compared to the salinity water with the increase of the organic matter content.
- Specimens with high pore fluid concentrations led to appearance of flocculated salt clusters on their exposed surface at low moisture contents.

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