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Study the Effect of Using Stone Cutting Slurry Waste (Al-Khamkha) on the Compaction Characteristics of Jerash Sandy Soil

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Abstract: The aim of this research is to study the effect of using stone cutting slurry waste al-khamkha, local name in Jordan on the on the compaction characteristic of Jerash sandy soil. The degree of compaction of a soil is measured in terms of its dry unit weight al-khamkha mixed with Jerash sandy soil at different amount ranges from 0, 5, 10, 15, up to 50% and compaction characteristics of Jerash sandy soil without and with different amount of al-khamkha was studied. This investigation show that as the amount of al-khamkha increase from 0-15%, the dry unit weight of Jerash sandy soil increase from 15.9 KN/m^3 at 0% of al-khamkha to 19.2 KN/m^3 at 15% and after that any increase of al-khamkha decrease the dry unit weight. On the other hand, the optimum water content of the Jerash sandy soil was increases with increasing the percentage of al-khamkha on the soil.

Key words: Al-khamkha, Jerash sandy soil, compaction, soil, Jordan

INTRODUCTION

In the construction of engineering structures such as highway embankments or earth dams, loose fills are required to be compacted to increase the soil density and improve their strength characteristics (Hankasson and Lipiec, 2000). Compaction is the most common and important method of soil improvement. Compaction or densification of soil is done by removed of air which requires mechanical energy (Batey, 2009). By which the soil grain get rearranged move closely (Batey, 2009). Compaction generally leads to an increase in shear strength and helps improve the stability and the bearing capacity of a soil and reduced the settlements (Ohu *et al*., 1989). The degree of compaction of a soil is measured in terms of dry unit weight (Gysi *et al*., 1999). The soil compaction process is highly influenced by the soil water content (Hamza and Anderson, 2005; Horn *et al*., 1995; Mosaddeghi *et al*., 2000).

MATERIALS AND METHODS

Moisture content has a strong influence on the degree of compaction achieved by a given soil, besides moisture content, other important factors that affect compaction are soil type and compaction effort.

The aim of this research is to study the effect of using stone cutting slurry waste al-khamkha on the dry unit weight and the moisture content of Jerash cohesive soil consequently, qualitative and quantitative analysis of soil compaction spots the light on soil strength characteristic performed for soil compaction to perform the compaction test, sample were taken from Eastern area of Jerash city in Jordan and al-khamkha was taken from factories hold the generated slurry in open basins in Jerash city.

The compaction test was conducted using "Standard Proctor test". The soil is mixed with varying amount of al-khamkha and then compacted in three equal layers.

The moisture unit weight relationship was plotted for each sample tested to obtain the maximum dry unit weight.

Standard Proctor test: Is the laboratory test used to obtain the maximum dry unit weight of compaction and the optimum moisture content, the soil is compacted unmold that has o volume of 944 cm^3.

The soil is mixed with varying amount of wetter and then compacted in 3 quell layers by a hammer that delivers 25 blows to each layer. For each test, the maximum dry unit weigh and the optimum moisture content were determined.

Stone cutting slurry waste (al-khamkha, local name): During the processing of cutting stone, the rawstone block is cut either into tiles or slabs of various thickness, using diamond blades water is showered on blades while stone blocks are cut into sheets of varying thickness (Turgut and Algin, 2007; Ammary, 2007). To cool blokes and absorb the dust produced during the cutting operation. The amount of the waste water from this operation is very large. It is not recycled as the water is so highly alkaline that if re-used at can dim the slabs to be polished (Almeida *et al*., 2007).

The cooling water is stored in pits until the suspended particles settle (sedimentation tanks) to cool blades.

Then, the slurry is collected in trucks and disposed off on the ground and left to dry this water carries larger amount of stone powder which leads to complex nature of environmental problems such as APHA:

- Choking of drains in ruing season
- Dust nuisance
- Find partials of lorry become air borne and cause air pollution
- Slurry dumped areas can't support vegetation and remain degraded

So, these waste material needs to be utilized meaningfully in economic way. However, particular stone cutting slurry waste may have different physical and chemical properties depending on the type of the stone and on the method of generation of waste in this research stone which used in building as a wall which mostly limestone was used (Arslan *et al*., 2005).

RESULTS AND DISCUSSION

To study the effect of al-khamkha on the dry unit weight and moisture content of Jerash sandy soils, samples were taken from Western part of Jerash city. The physical properties of the soil used this on tardy are given in Table 1.

The physical and chemical characteristics of al-khamkha which used in this research were shown in Table 2 and 3.

Table 3 illustrate the average of physical and chemical characteristic of al-khamkha which used in this research. The result of analysis was compared with other result.

The test was conducted by mixed the Jerash sandy soil with different amount of al-khamkha and compacted using "Standard Proctor test". The optimum water content and maximum dry shown in Fig. 1 and Table 4.

Table 1: Physical properties of Jerash sandy soil

Gravel (%)	Sand (%)	Silt and clay (%)
9.2	82	8.8

Table 2: Physical properties of powder stone waste

Types of stone	Specific gravidity	Bulk density	Color
Lime stone	2.6-2.65	15.7-17.5	White/dirty white

Figure 2 and 3 show that as the amount of al-khamkha increase from 0-15%, the dry unit weight of Jerash sandy soil increase from 15.8-19.2 KN/m^3 and the optimum water content also increase from 6.5-10.2%. After that as al-khamkha increasethe dry unit weight of Jerash sandy soil was decrease and optimum water content silt increase.

These results provide information about how may manage the compaction and environment problem of al-khamkha to a wise procedure without wasting time and money.

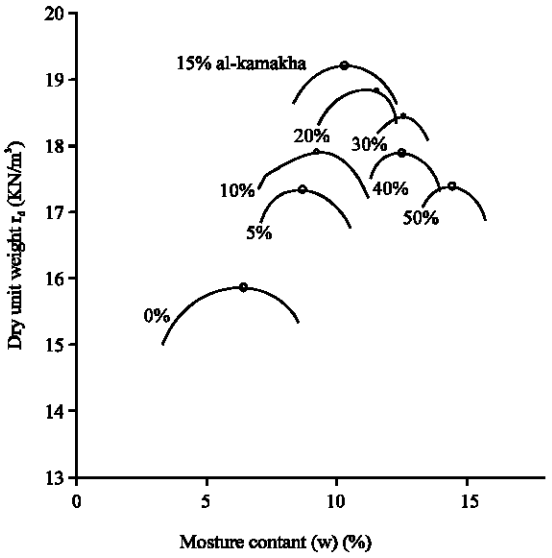

Fig. 1: "Standard Proctor test" the optimum water content and maximum dry unit weight were obtained for trial

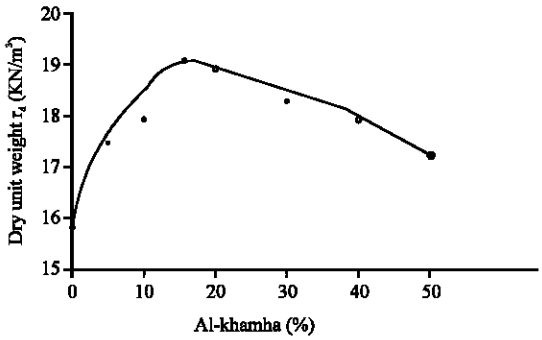

Fig. 2: Effect of al-kamkha on the compaction characteristic of Jerash cohesive soil

Table 3: Chemical properties of powder stone waste (MPWH, 1985)

Types of stone waste	Calcium oxide (%) (CaO)	Silica (%) (SiO_2)	Aluminum trioxide (%) (Al_2O_3)	Ferrous oxide (%) (Fe_2O_3)	Magnesium oxide (%) (MgO)	Loss on ignition (%) (LOI)
Lime stone waste	49.9	9.92	1.06	0.404	0.2	38

Table 4: The results of stsnd proctor test on Jerash sandy soil with different amount of al-khamkha

Percentage of al-khamkha (%)	Dry unit weight (KN/m^3)	Optimum water content (%)
0	15.8	6.5
5	17.2	8.9
10	17.8	9.2
15	19.2	10.2
20	18.8	11.5
30	18.2	12.6
40	17.9	13.4
50	17.3	14.6

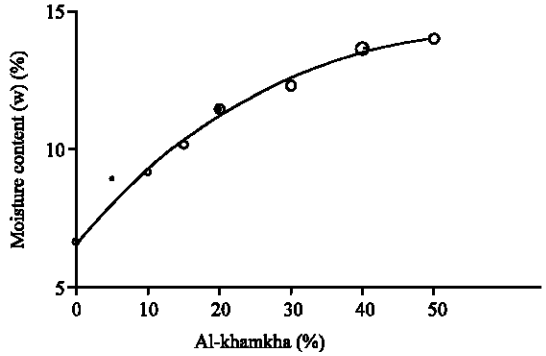

Fig. 3: Effect of Al-kamkha on the compaction characteristic of Jerash cohesive soil

CONCLUSION

This investigation focuses on the effect of al-khamkha oncompaction characteristicsJerash sandy soil. These results show that as amount of al-khamkha mixed with sandy soil increases, the dry unit weight of Jerash sandy soil and the optimum water content also increase.

The dry unit weight of Jerash sandy soil was increase from 15.8 KN/m^3 at 0%. Of al-khamkha to 19.2 KN/m^3 at 15% of al-khamkha which mean that as al-khamkhaincrease the dry unit weight of Jerash sandy soil increase by 22% without wasting time and money and solve the environmental problem of al-khamkha.

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