Suitability of Quaternary Deposits in Alam Area as Filing Materials in Earth Fills Dams

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Abstract
The Study aims to evaluate the suitability of quaternary deposits in AL-Alam area as filling materials in earth fill dams. The geotechnical properties of deposits for three stations show that the type of soil is (ML) and the curves of grain size analyses confirm the curve of Zone C., while the ratio of total dissolved salts(TDS) and gypsum contents ranges between (2.71-8.61)% and (0.18-0.68)% respectively The values of liquid limit and plastic limit ranges between (40.2-44.7)% and (10.5-13.7)% respectively. According to Iraqi specification, the deposits of station (3) are suitable for filling materials in earth dams, while the geotechnical properties of the deposits in the stations (1) and(2) are within the specifications ranges except the ratios of (TDS).

Keywords: Quaternary Deposits, Filling Materials, Earth fill Dams

Introduction
There are two types of tests which are performed on soil to assess its suitability as filling materials in earth fill dams. The first test deals with the grain size analysis and atterberg limits which can be classified as indicators; this test provides designers and Technical properties with the sufficient details about the nature and properties of the materials. The second one consists of measuring the specific gravity and permeability of soil, and the tri-axial compression test. These measurements are essential for dams' design [1]. Based on the level of risk assessments which dams present, they are categorized into three sets [2]:

1. Category 1: The height of dams under this category is generally less than 10 m. The safety factor of the dams is low, which only need maintenance.
2. Category 2: The dams in this category have height between 10 m and 25 m. These dams usually require more detailed investigation and maintenance, and their safety factor is relatively high.
3. Category 3: This category has dams with heights which are more than 25 m. The dams in this category demand a high safety factor, a regular maintenance, and high quality construction materials, in addition it needs detailed investigation of the dam's site.

The Study Area:
The study area is in Alam sub-district which is located in the east of Tikrit city in the north of Iraq, between 43° 40' 00"E and 43° 30' 00"E (longitude) and between 34° 40' 00"N and 34° 30' 00"N (latitude). This area is bounded by the Tigris from the west and Alam from the east.

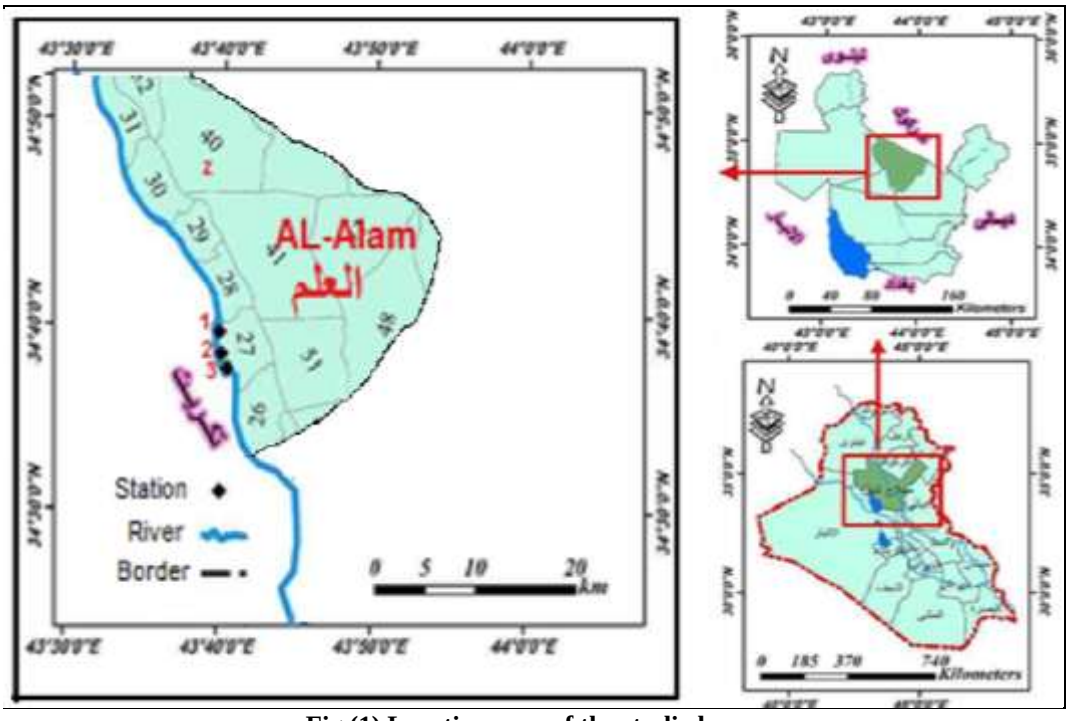

Fig (1) Location map of the studied area

Aim of Research

The purpose of this research is to investigate the suitability of quaternary deposits uses as filling materials in earth fill dams by examining its geotechnical properties and comparing them with standard specifications.

Geology of the Study Area

The study area is covered with quaternary deposits which is mixed of gravel, sand, silt and clay, plate (1). In [4], Jasim studied the area between Baiji and the south of Samaraa which he discovered that the quaternary deposits are exposed in this area and composed of fine and coarse sand and gravel. Similar components exist and cover wide areas with different thicknesses.

Plate (1) sampling method

Field Work

Field work are considered as a very important stage in establishing ideas to form a successful study plan. These visits generally have an on-site investigation of the study area, in addition to observe the geological and geomorphological landforms and recording of detailed information of the study area. The field work started with an exploration of the study area in January 2017 to examine the nature of formations in the area and specify the various field measurements. In the second field visit, the stations were selected and samples were taken from three different locations. Using manual sampling method, one sample per station was chosen, and the coordinates of the chosen stations were recorded by a GPS. The samples were saved in plastic bags labeled with the station number and sampling location, to be used for further tests

Laboratory Test

Grain Size Analysis

The grain size analysis test plays a significant role in defining the soil type according to its grain size. There are two types of soil: the first one is soil with coarse grains which is gravel and sand; the second type of soil is the one with fine grain which is silt and clay [5]. Table (1) shows sieve analysis which are used for grain size analysis [6, 7].

Table (1) Sieve Number used in grain size analysis

U.S Standard Sieve Number	Opening (mm)	Type of Soil
4	4.75	Gravel
10	2.00	Coarse Sand
40	0.425	Medium Sand
200	0.075	Fine Sand
Pan	0.075	Fines (Silt, Clay)

The grain size analysis is performed in two stages: the first is dry sieving analysis to separate the grains of sizes of more than (0.075) mm, and the 2nd is wet analysis which is used to separate the grains of sizes of less than (0.075) mm. This test was done according the standard in [8] and the U.S. standard [9]. Table (2) and Figures (2, 3, and 4) show grain size analysis results.

Table (2) The results of grain size analysis

Clay %	Silt %	Sand %	Station No.
25	64	11	1
18	63	19	2
23	55	22	3

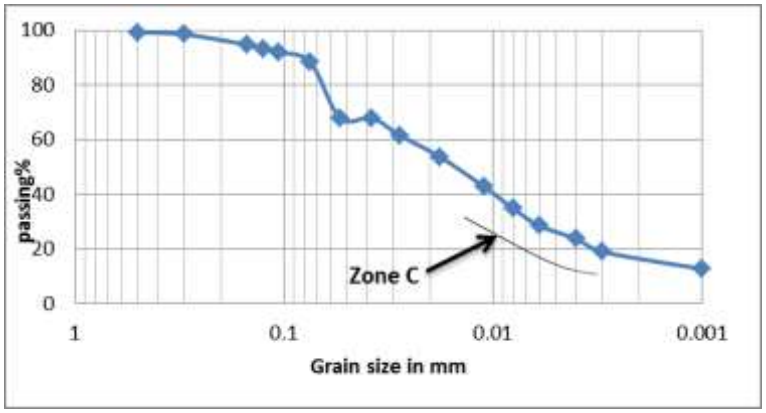

Fig (2) grain size analysis curve for station (1)

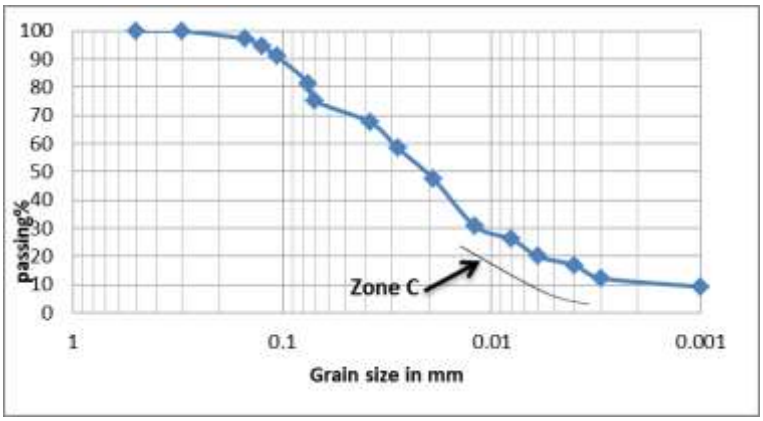

Fig (3) grain size analysis curve for station (2)

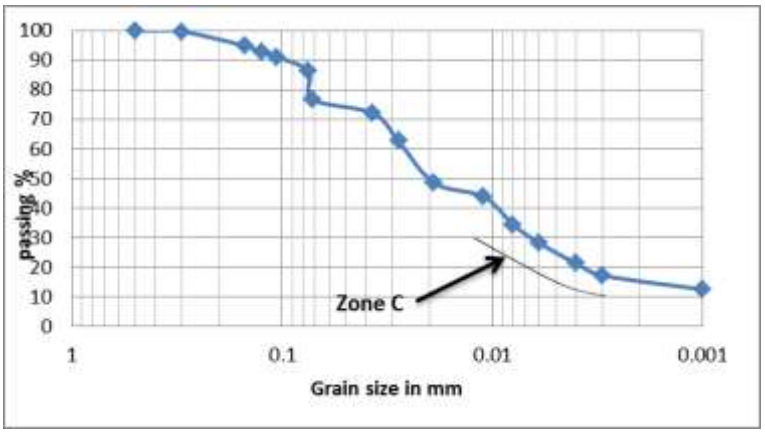

Fig (4) grain size analysis curve for station (3)

Atterberg Limits:

These limit describe the water content of soil, in which the soil change from one state to another [10]. The liquid limit and the plastic limits were done at the Applied Geology Department in Tikrit University according to the U.S. Standard [10]. The Atterberg Limits are used to categorize the soil and define its engineering properties, see Table (3) and Figure (5).

Table (3) Atterberg Limit for the study area

Plasticity index P. I	Plastic limit P. L%	Liquid limit L. L%	Station No.
10.5	31.7	42.2	1
11.9	32.8	44.7	2
13.7	26.5	40.2	3

The Quaternary Deposits in the studies area were classified according to the unified classification system as in fig (5).

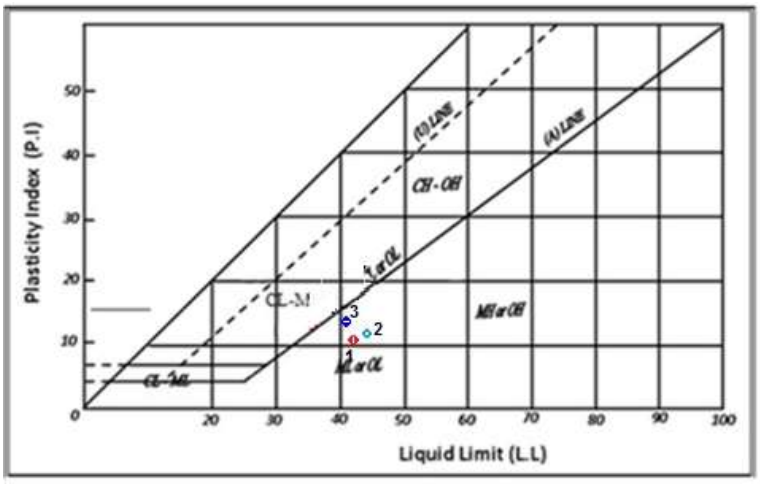

Fig (5) The plasticity chart for the study area

Chemical Properties of the Deposits in the Study Area: The chemical analysis of soil are important in evaluating the suitability of soil for engineering purposes. For example, if the gypsum content of soil exceeds the standard limit, the soil will suffer a dissolution problem, and this problem occurs frequently in areas of the Salah Addin province. Therefore, in order to say that the of quaternary

deposits are suitable as filling materials, their gypsum content and total dissolved solids (TDS) must be within the acceptable limits according to the standardized specifications. Table (4) represents the chemical analysis results of the deposits in the study area the methods of testing in [11] were used.

Table (4) chemical analysis of the deposits in the studied area

No. Station	Gypsum %	T.D.S %
1	0.81	8.61
2	0.68	6.51
3	0.38	2.71

Suitability of Quaternary Deposits as Filling Materials:

Many standards are available to be used for comparison to evaluate the suitability of deposits as filling materials. Of these standards are the physical and chemical standards [12], Table (5).

Table (5) The physical and chemical properties of the filling soil

Physical & Chemical Properties	Range uses
Grain Size Analysis	Matching Curve C
Plasticity Index	Ranges from (10-20)%
(TDS)	Not above 4.4%
Gypsum Content	Not above 4.4%
Liquid limit	Not above 55%

From the comparison of the results with the standards shown in Table (5), it is clear that the liquid limit, the plasticity index, gypsum content, and grain size analysis curve of each station are all within the standard. On the other hand, the total dissolved solids (TDS) are not on the same trend as the other properties, where it is within the standard limits in station (3) and off the limits in stations (1 and 2).

Conclusion

1-The study shows that the deposition of the area is a silty with low elasticity .

2-The chemical analysis of the sediments shows that the rates of the gypsum is ranging between (0.38-0.81 %), and the total soluble salts is ranging between (2.71-8.61 %).

3-Whom comparing the chemical and physical properties of the area of the study with the Iraqi standing limits [13], it shows the suitability of the sedimentations of the station (3) as filling martials , sin G it falls with in the limits of the standard .But in the stations (1,2) it falls beg and the limits of the standard conking the total soluble salts .

Recommendation

1-We recommend to study the reserve estimation of the Quaternary deposits .

2-Study the suitability of the deposits for industry dimension and for ceramic industry .

3-Anothor search should be held to study the Mineral logical content of this deposits of Clay Minerals.

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صلاحية ترسبات العصر الرباعي في ناحية العلم كمواد املائية في السدود الترابية

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الملخص

يهدف البحث الى بيان صلاحية ترسبات العصر الرباعي في ناحية العلم كمواد املائية حيث تم اختيار (3) محطات ممثلة لهذه الترسبات في المنطقة. اظهرت الفحوصات الجيوتكنيكية ان هذه الترسبات هي من نوع سلتية واطئة اللدونة كما تبين ان منحنيات التحليل الحجمي الحبيبي تطابق نطاق (C) (Zone c) في ما اظهرت الفحوصات الكيميائية لمجموع الاملاح الذائبة والمحتوى الجبسي نسبا تتراوح بين (8.61−2.71)% و(0.68−0.18) % على التوالي. وتراوحت قيم حد السيولة ومعامل اللدونة بين (44.7−40.2)% و(13.7−10.5)% على التوالي ووفقا للمواصفات المواد والاعمال الانشائية للمركز الوطني للمختبرات والبحوث الانشائية ($sorb/r_5$) لسنة (2003) تبين ان ترسبات المحطة (3) تصلح كمواد املائية بينما المحطتين (1) و(2) فان الخواص الجيوتكنيكية لترسباتها ضمن حدود المواصفة باستثناء نسب مجموع الاملاح المذابة الكلية (TDS) فانها خارج حدود المواصفة.

الكلمات المفتاحية: ترسبات العصر الرباعي, مواد املائية, السدود الترابية.