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The Chemical Properties of The Lower Zab River Deposits and their Possibility to Use for Concrete Works in Dibbs Area Northwest Kirkuk / Northern Iraq.

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Abstract

The current study amid to chemical evaluation of the Lower Zab river sedimentsof the Dibbis area northwest Kirkuk to determine the validity of these sediments for concrete works. Three samples were taken from the river bank, where the results of the (sulphate content, gypsum content, organic matter content, TTS and PH value) are all conform with the limits of the standard specifications(B.S. 1377-1990). The results of the sulphate content were (0.35, 0.78, 0.74%) respectively, gypsum content results were (0.75, 1.67, 2.91%) respectively. The organic matter results were (0.97, 1.01, 0.84%), the TTS results (1.42, 1.51, 1.36%) in addition to PH value (7.62, 7.81, 7.98 %). Thus, after compared the results with the limits of the standard specification, all samples of the study area are suitable for use in concrete works.

Key word: lower zab river; Dibbs; Kirkuk; chemical properties; aggregate; concrete

الخواص الكيميائية لترسبات نهر الزاب الاسفل و امكانية استخدامها للأعمال الخرسانية في منطقة الدبس شمال غرب كركوك / شمال العراق

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الملخص

يهدف البحث الى تقييم الخصائص الكيميائية لترسبات نهر الزاب الاسفل في منطقة الدبس شمال غرب كركوك لتحديد امكانية استخدامها لاعمال الخرسانة. تم جمع ثلاثة نماذج من منطقة الدراسة و كانت نتائج التحليل الكيميائي لمحتوى الكبريتات ، محتوى الجبس ، محتوى المواد العضوية ، مجموع الاملاح المذابة الكلية و قيمة الاس الهيدروجيني) تتوافق مع حدود المواصفات البريطانية المرقمة 1377 في 1990. وجد ان نتائج محتوى الكبريتات كانت (0.35 ، 0.78 ، 0.74%) على التوالي و محتوى الجبس (0.75، 1.67، 2.91%). و محتوى المواد العضوية (0.97، 1.01، 0.84%) و محتوى الاملاح الكلية المذابة (1.42، 1.51، 1.36%) بالاضافة الى قيمة الاس الهيدروجيني (7.62، 7.81، 7.98%). و من ملاحظة النتائج و مقارنتها مع حدود المواصفات اعلاه تبين ملائمتها للاعمال الخرسانية.

الكلمات المفتاحية: نهر الزاب الاسفل، الدبس، كركوك، الخصائص الكيميائية، الركام، الخرسانة

1- Introduction

Aggregate defined as the main component in the concrete works since it forms the concrete body and reducing shrinkage, where it occupying the greater part overall volume of the concrete (Tinni & Consulting, 2013). Since the aggregate constitute the main portion of the total concrete volume, so, studying their properties very important because the concrete properties depend upon it (Neville,2011). In addition to that should make sure about the chemicals ration in the aggregate because it also has great effect on the concrete properties if it exceeds the permissible limits (McNally,1998). The most important justifications for the current paper, identify the chemical properties of the aggregate derived from the banks of the lower zab river in the Dibbs region in Kirkuk province to determine it is suitability for concrete works. the study aims to describe the chemical properties for the lower zab river deposits to identify it is validity for concrete works in the Dibbs area northwest Kirkuk. These include (sulphate content, gypsum content, total soluble salt (TSS), PH value). Many previous studies were conducted about the same topic. (khuder, 2017) he studied Some Quaternary Deposit Geotechnical Properties in the AL_Mahzam Area Salahadden and its Applicability in Concrete, concluded that all samples are suitable to using for concrete production after compared with the British Standard. (Khudhur, 2021) he studied the Tigris River Sediments from Tikrit, Northern Iraq, the results were Suitable for Concrete Production and Road Construction. The samples results were found to be suitable to these uses after being compared to the British standard limits for concrete and road works. (Hassan et al.,2023) studied the Lower Zab River Sediments Suitability for Concrete Works in Southwest of Kirkuk city - Northern Iraq, he deduced the results were compliant with the British Standards, hence all samples are suitable for the concrete works.

2- Location and Geological Setting of the Study Area

The study area is located in the Kirkuk governorate, Dibbs region, northeastern of Iraq in between of longitudes (44° 03' 14"- 44° 03' 25") E and two latitudes (35° 39' 07"- 35° 40' 52") N.

In tectonic terms, the study area located on the foothill zone at the Chemchemal-Butmah subzone, which belong to the unstable shelf (Jassim and Goff, 2006). The stratigraphy of the study area represented by Fatha, Injana, Mukdadiya, Bai Hassan formations and recent (quaternary deposits) deposits (Buday 1980) (Jassim and Goff 2006). Fatha formation forms at shallow marine environment (Buday, 1980). Fatha formation dominated by evaporitic facies (halogeneous and sulphatic), where consist

of anhydrite, gypsum, limestone, sandstone, marl, siltstone, claystone and conglomerate (Budy and Jassim,1987) (Sadeq and Mohammed, 2022). Injana formation consist of sandstone alternating with marls, mudstone and brownish red siltstones, as well as relatively rare freshwater limestone (Bellen et al. 1959) (Ali et al. 1988). Injana formation of two parts, where the lower part deposited in transitional environment while the upper part deposited in fluvial environment (Tamar-Agha et al., 2015). Mukdadiya formation deposited in the fluvial environment (AL-Naqqib, 1960), consist of sandstone, pebbly sandstone, siltstone, claystone and bed of conglomerate in contact with the Bai Hassan formation (Al-Naqib, 1959) (Ali, 2021). Bai Hassan formation deposited in fluvial environment (AL-Janabi, 2008), is made up of thick layers of conglomerate interbedded with sandstone, siltstone and claystone (Buday, 1980). Quaternary deposits consist of semi-cohesive deposits such as gravels, sand, silt and clay in an overlapping way of Pleistocene-Holocene age covering the Bai Hassan Formation, it has a significant economic role in many construction projects (Saleem, 1978).

3- Materials and Methodology

The field work involves two stages, the first one represented by taking a reconnaissance tour in the study area to identify the geological setting and geomorphological conditions. while the second stage involve taken three samples according to (ASTM-D75, 2004), in addition to plot the coordinate of the samples stations by using GPS device on the location map of the study area as well as taking

photos to illustrate the location of the samples.

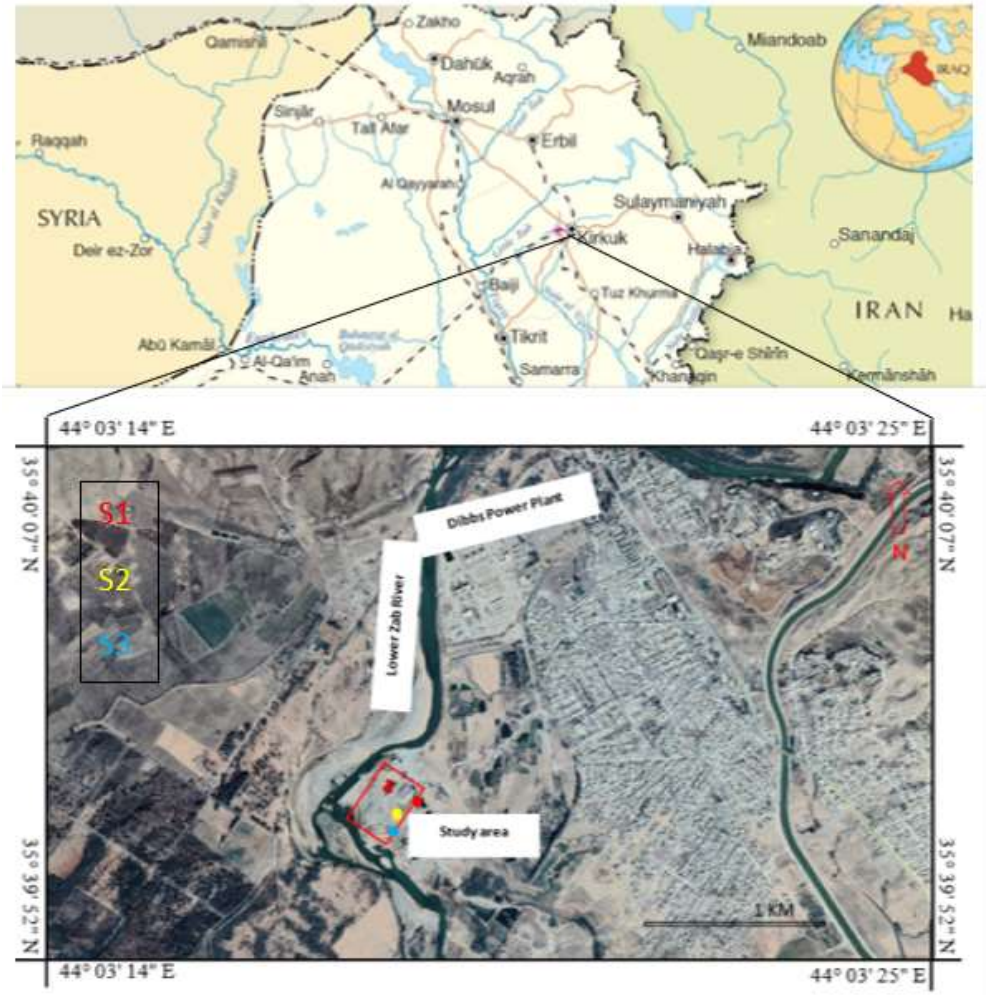

Fig.1 location of the study area

Laboratory works involve to conduct chemical analysis:

3-1 Sulphate content

Sulphate ion (SO3) is described as a salt having a negative ionic charge that may be dissolved in water (Kheder and Assi, 2009), 90% of them is created by weathering process of gypsum where this ion lead to affect the produced concrete properties (Suleiman, 2022). The test was conducted in national center for construction laboratories and research (Kirkuk branch) by the method of extraction of sulfate salts using dilute hydrochloric acid at a concentration 5% according to (BS, 1377-T5,1990). Where states it is value must not exceed (5%) according to the

specification limits.

3-2 Gypsum content

Gypsum is a salt described as a hydrated calcium sulphate (CaSO4. 2H2O) with a low specific gravity (2.32), has a significant impact on the physical and mechanical characteristics of the aggregate (Nashat, 1990). The test was conducted in national center for construction laboratories and research (Kirkuk branch) also by the method of extraction of sulfate salts using dilute hydrochloric acid at a concentration 5% according to (BS, 1377-T5,1990). Where the results of the gypsum content should not exceed (10.75%).

3 -3 Organic matter content

It is a material that formed by decomposition of the plant residue in aggregates and appear in the form of the organic loam or humus and organic matter interfere with the process of hydration of cement which lead to reduce the concrete compressive strength also has effect on the concrete durability (Neville,2011) (Liu et.al., 2018). The test was conducted according to (B.S. 1377-1990-T.3) in the national center for construction laboratories and research (Kirkuk branch) which stipulates that the percentage of organic matter should not exceed (%2).

3-4 Total soluble salt

salts are a material that can be dissolved easily in water where it is solubility depending up on the nature of it, the solubility degree can significant effected by factors such as PH value, amount of dissolved CO_2, in addition to moisture and evaporation (Al-Mamoori et al., 2019). The test was conducted according to (ASTM Earth Manuel Designation E8 & SORB, 2004) in national center for construction laboratories and research (Kirkuk branch) where the results value of which should not exceed 10% according to (Earth Manual – Designation E8 & SORB, 2004).

3- 5 PH value

Is a unit used to describe the soil solution acidity and alkalinity, which can be alkaline when the PH value exceed 7 and acidity when it less than 7, as well as neutral when the value is 7 (Miller, 2016). PH was calculated in national center for construction laboratories and research (Kirkuk branch) according to (B.S. 1377-1990- T9).

4- Results and Discussion

The chemical analyzes includes sulphate content where the values ranged between 0.35 - 0.78% as shown in the Table 1, thus the results within the acceptable limits of the sulfate content allowed to be present in the aggregate. Table 2 shown the gypsum content results ranged between 0.75 – 2.91%, where the results complies with the specification limits of the gypsum content allowed. Table 3 shown the results of the organic matter content, where the values ranged between 0.84 – 1.01%, thus the results within the acceptable limits of the specification of the organic matter. the results of the total soluble salts were ranged between 1.36 – 1.56% as shown in the Table 4, the results are conformed to the standard specification limits of the total soluble salts. the PH value was ranged between 7.62 – 7.98% as shown in table 5, the results tend to be neutral alkalinity, thus, they considered unsuitable to concrete works.

Table 1. sulphate content in the samples

Station	SO3%	Limits of (B.S. 1377-1990-T.5)
1	0.35	5 % MAX
2	0.78	
3	0.74	

Table 2. Gypsum content in the samples

Station	Gypsum %	Limits of (B.S. 1377-1990-T.5)
1	0.75	10.75 % MAX
2	1.67	
3	2.91	

Table 3. Organic matter content in the samples

Station	O.M.C %	Limits of (B.S. 1377-1990-T.3)
1	0.97	2 % MAX
2	1.01	
3	0.84	

Table 4. TSS content in the samples

Station	T.S.S%	Limits of (Earth Manual – Designation E8 & SORB, 2004)
1	1.42	10 % MAX
2	1.51	
3	1.36	

Table 5. PH value of the samples

Station	PH %	Soil type
1	7.62	Neutral alkalinity
2	7.81	Neutral alkalinity
3	7.98	Neutral alkalinity

5- Conclusion

The results of chemical analysis of the samples of the study area showed their compliance with the limits of the standard specifications to be met for aggregates used for concrete purposes. The highest percentage of sulfate content in the aggregate appears in the second sample and was at 0.78%, therefore the value corresponds to the limits of (BS 1377-1990-t. 5), while the highest value of the gypsum content was 2.91% at the third sample, thus, the results comply with the Limits of (B.S. 1377-1990-T.5). in the second sample the highest percentage of the organic matter content was 1.01% where it complies with the Limits of (B.S. 1377-1990-T.3). about the total soluble salts, the highest percentage was at the second sample with 1.51% also complies with the standard specification limits of Limits of (B.S. 1377-1990-T.9). the PH value tend to be neutral alkalinity thus described to be unsuitable for concrete works.

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