WATER QUALITY OF DOHUK DAM STREAM OUTFLOW

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Abstract

The Dohuk dam is located on the north of Dohuk city, it is consider as one of the main sources for water supplying to many places in the city for drink and domestic uses, dam water flowing through the narrow stream within the Dohuk valley finally reach to the Mosul dam. The study covered three locations from the Dohuk dam outflow stream, first from the bottom tunnel of the dam, second in Bourse bridge and third in Church bridge, the samples were taken from October 2010 until February 2011. The research aimed to water quality monitoring by determination some of physical, chemical and biological properties with respect to its potability for human uses.

The electrical conductivity (EC) and total dissolved solids (TDS) values of water reach to 1116 µs/cm and 899 mg/l, pH value was 9.1 in Bourse bridge location. Water of the Dohuk dam outflow stream was on the alkaline side. Total hardness recorded 603 mg/l CaCO3 in Church bridge location. The water of Dohuk dam outflow stream was classified as hard water as its hardness was higher than 300 mg/l (WHO, 2006).

The Dissolved oxygen (DO) values were decreasing through the Dohuk dam outflow stream to reach 6.0 mg/l in Church bridge location. The values of Biochemical Oxygen Demand (BOD) increasing through the dam outflow stream to reach 4.1mg/l in Church bridge location, the number of bacterial colonies also increasing in the stream flow which was reached to 432 cells/ml in Church bridge location.

Key words: Dohuk dam, water quality, monitoring water properties, domestic discharge.

Introduction

The freshwater for human consumption comes from rivers, lakes and underground. These sources account for only one percent of all water on the earth (Gebrekidan and Samuel, 2011). It is able to dissolve, adsorb or suspend many different compounds (WHO, 2007).Thus, in nature, water is not pure as it acquires contaminants from natural and anthropogenic sources (Momodu and Anyakora, 2010).

The presence of metals in water results from two independent factors. The first involving the weathering of soils and rocks with its products being transported by air and water, and the second involving a variety of anthropogenic activities that have created and a societal health risk in rivers that receive a substantial amount of waste (Roberto *et al.*, 2008).

Quality drinking water is essential for life, good drinking water quality is essential for the wellbeing of all people. Contaminants such as bacteria, viruses, heavy metals, nitrites and others found their way into water supplies as a result of inadequate treatment and disposal of solid and liquid waste (human and livestock), industrial discharges, and over-use of limited water resources (Singh and Mosley, 2003).

This paper focus on the water quality of Dohuk dam outflow stream by selected three locations.

Methods and Materials

The studied area include water discharged from Dohuk dam that moved with stream reach to the Dohuk valley and finally reach to Mosul dam, the study based on three locations from the Dohuk dam outflow stream, first from Dohuk water dam after flowed and second location of this water in Bourse bridge then third in Church bridge through October 2010 to February 2011. All water samples were kept in polyethylene bottles (Stankovic *et al.*, 2007).Water samples were tested the, electrical conductivity, total dissolved solids, pH, dissolved oxygen, BOD, total hardness and bacteria test. The tests were conducted according to the following methods (APHA, 1999)

Electrical Conductivity (EC)

Conductivity was estimated by electrical conductivity meter, "InoLab EC, TDS Level 1, HANNA instrument, WTW ", the prop was calibrated monthly by buffer solution, on the reading the conductivity values were converted to specific conductivity at 25C^{o} and the results were expressed by as µs/cm.

Total Dissolved Solid (TDS)

The amount of the total dissolved solids in water was estimated by TDS meter "InoLab EC, TDS Level 1, HANNA instrument, WTW ".

Hydrogen Ion Concentration (pH)

The pH was measured directly by using portable pH meter "InoLab pH Level 2, HANNA instrument, WTW", pH meter was calibrated with three buffer solutions of pH 4,7and 9.

Dissolved Oxygen (DO)

Determination of oxygen was carried out according to the Winkler's method (Azide modification) as describing by (APHA, 1999) the results were expressed in mg/l.

Biochemical Oxygen Demand (BODs)

The water sample saved in incubator during 5 day under 20C^{o} after that determine dissolved oxygen by Winkler's method (Azide modification) as describing by (APHA, 1999), the results were expressed in mg/l.

Total Hardness

Estimated of total hardness was made by titrating water samples against EDTA disodium salt with Eriochrome black T indicator at pH 10 (using ammonium buffer) the results were expressed in mg/l CaCO3 (APHA, 1999).

Bacteria Test

Estimated by Total Plate Count (TPC) (APHA, 1999).

Results and Discussion

The Electrical conductivity of water clarify from the Table 1, that the minimum value of 801µs/cm was recorded in Bourse bridge location and maximum value of 1116 µs/cm in Church bridge location. Fig.1 elucidate increasing mean of EC through the dam outflow stream to reach 937µ s/cm in Church bridge location this increasing occurred as a result to the domestic wastes discharge to this stream (Fatoki *et al.*, 2001), and the interactions between the acidic compounds which form from oxidation decomposition processes with basic compounds that found as suspended materials (Al-Saffawi *et al.*, 2009).

Table (1): Demonstrate the minimum, maximum and mean values of study parameters in study sites.

Parameters / Sites		EC □s/cm		TDS mg/l		pH		Total Hardness CaCO3 mg/l		DO mg/l		BOD mg/l		Bacterial colonies TPC Cells /ml	
Dohuk dam	min	803	min	620	min	7.4	min	340	min	7.7	min	1.0	min	53
	max	1004	max	781	max	8.0	max	471	max	9.2	max	1.4	max	92
	mean	871	mean	688	mean	7.7	mean	419	mean	8.4	mean	1.2	mean	76
Bourse bridge	min	801	min	625	min	8.3	min	322	min	6.1	min	2.5	min	138
	max	1126	max	857	max	9.1	max	587	max	9.0	max	3.2	max	197
	mean	907	mean	721	mean	8.5	mean	430	mean	7.3	mean	3.0	mean	169
Church bridge	min	816	min	679	min	8.2	min	408	min	6.0	min	3.3	min	246
	max	1116	max	899	max	8.7	max	603	max	7.8	max	4.1	max	432
	mean	937	mean	785	mean	8.5	mean	487	mean	6.7	mean	3.8	mean	408

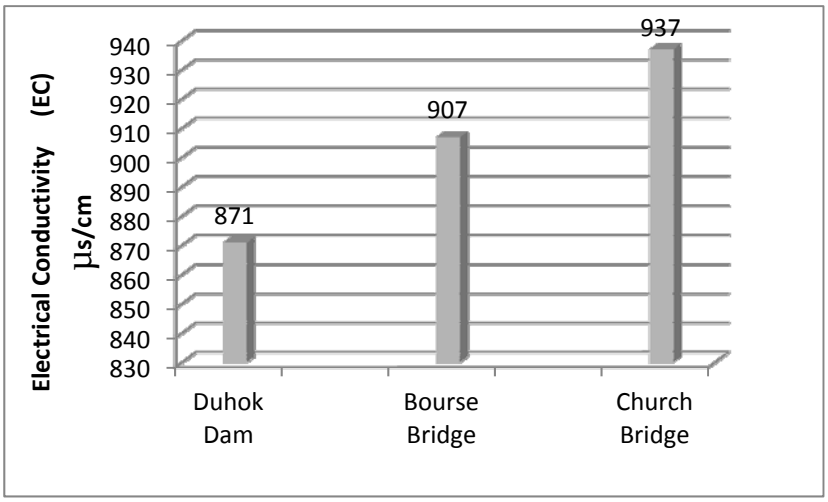

Figure (1): The mean value of (EC) in study locations.

The total dissolved solids of water represented in the Table 1, the minimum value of 620 mg/l was recorded in Dohuk dam location and maximum value of 899 mg/l was in Church bridge location, it is appear from Fig.2 that the increasing mean of TDS through the dam outflow stream to reach 785 mg/l was in Church bridge location caused by the effects of liquid wastes reach to it. All of the recorded values were above the minimum level of drinking water standard for drinking recommended by WHO and EPA (500 mg/l) (WHO, 1993; EPA, 2006).

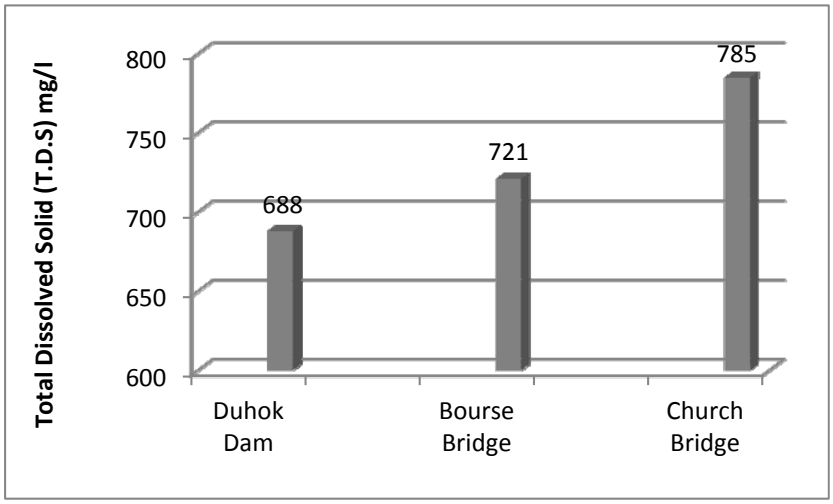

Figure (2): The mean value of (TDS) in study locations.

pH values of water represented in Table 1, the minimum value of 7.4 was recorded in Dohuk dam location, while maximum value of 9.1 was recorded in Bourse bridge location. Fig.3 illustrated mean of pH through Dohuk dam outflow stream to reach 8.5 in Bourse and Church bridge locations, the water of the dam outflow stream was on the alkaline side (7.4 - 9.1), this may due to the presence of carbonate and bicarbonate as dependent on the geology of area in additional to the nature of pollutants which reach to the stream such as detergents that has alkaline effect on the water (Adefemi *et al.*, 2007; Akoto and Adiyiah 2007).

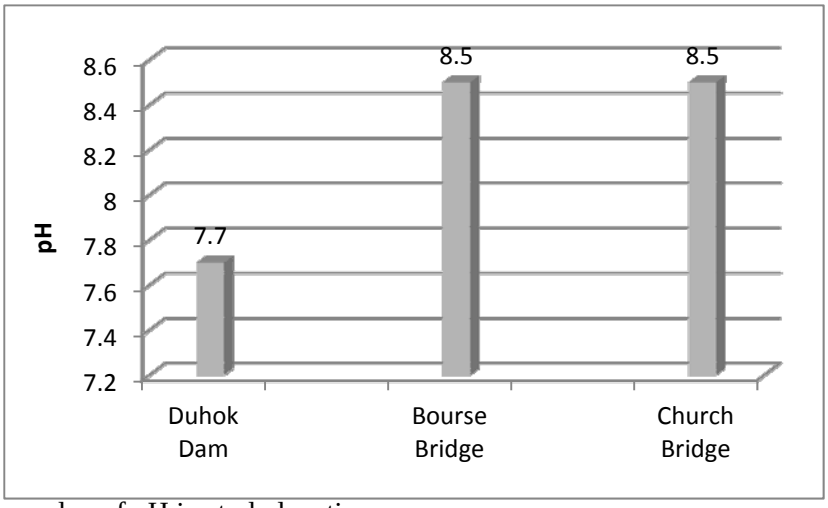

Figure (3): The mean value of pH in study locations.

The minimum value of total hardness was recorded in Bourse bridge location (322 mg/l CaCO3) and maximum value of (603 mg/l CaCO3) was recorded in Church bridge location. Fig.4 illustrated increasing mean of total hardness through the dam outflow stream that reach 487 mg/l CaCO3 was in Church bridge location**.** This increasing occurred as a result to the domestic and agricultural wastes discharge to this stream (Al-Barware and Al-Jahssany, 2009; Al-Saffawi *et al.*, 2009) and wastes from soil during the rain seasons, the variation of hardness is probably related to the geological formation of the area (Al-Negashabandi, 2002; Shihab and Abdul Baqi, 2010; Adefemi *et al.*, 2007), most values of water total hardness was lower than the hardness recommended by WHO of 500 mg/l CaCO3. The water of Dohuk dam outflow steam was classified as hard water as its hardness was higher than 300 mg/l. (W.H.O, 1993).

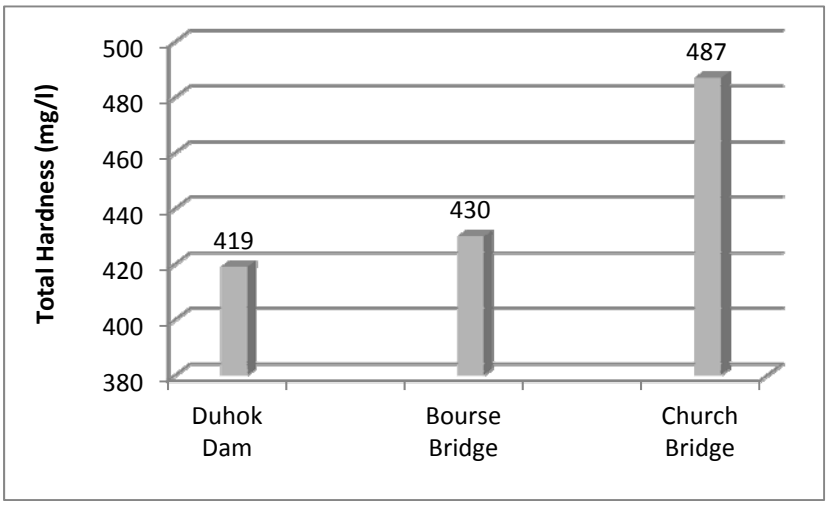

Figure (4): The mean value of Total hardness in study locations.

The Dissolved oxygen values of water represented in Table 1, the minimum value of DO was 6.0 mg/l recorded in Church bridge location and maximum value of 9.2 mg/l was in Dohuk dam location. Fig.5 illustrated decreasing mean of DO through the dam outflow stream to reach 6.7 mg/l in Church bridge location this decreasing occurred as a result to the oxidation and decomposition processes for organic materials by bacteria, The increase domestic and agricultural wastes into the environment helps the growth of bacteria by oxidation processes (Al-Jahssany, 2003; Al-Barware,2004).

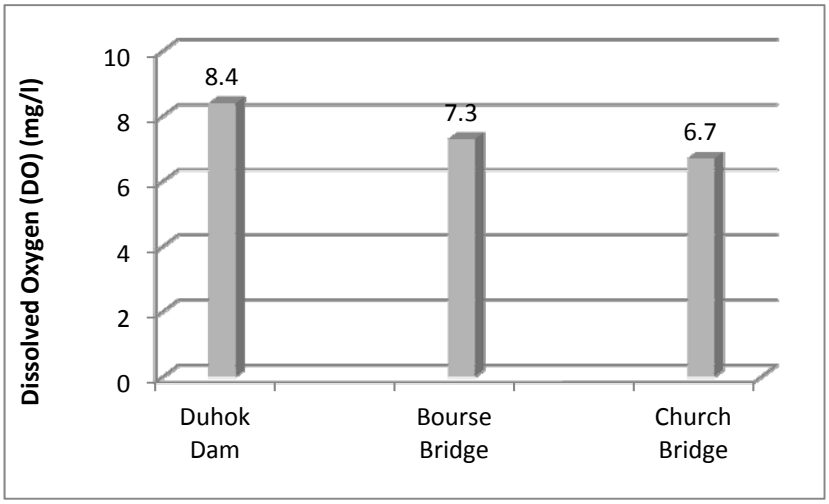

Figure (5): The mean value of (DO) in study locations.

Biochemical Oxygen Demand (BOD) values of water represented from the Table 1, the minimum value of 1.0 mg/l was recorded in Dohuk dam location and maximum value of 4.1 mg/l was in Church bridge location. Fig.6 illustrated increasing mean of BOD values through the dam outflow stream to reach 3.8 mg/l in Church bridge location. This increasing result from the domestic and agricultural wastes discharge to the dam outflow stream which contain organic matter, contain different types pollutants and detergents in additional to residual dead algae through the stream (Osibanjo *et al.*, 2011; Soylak *at el.*, 2002).

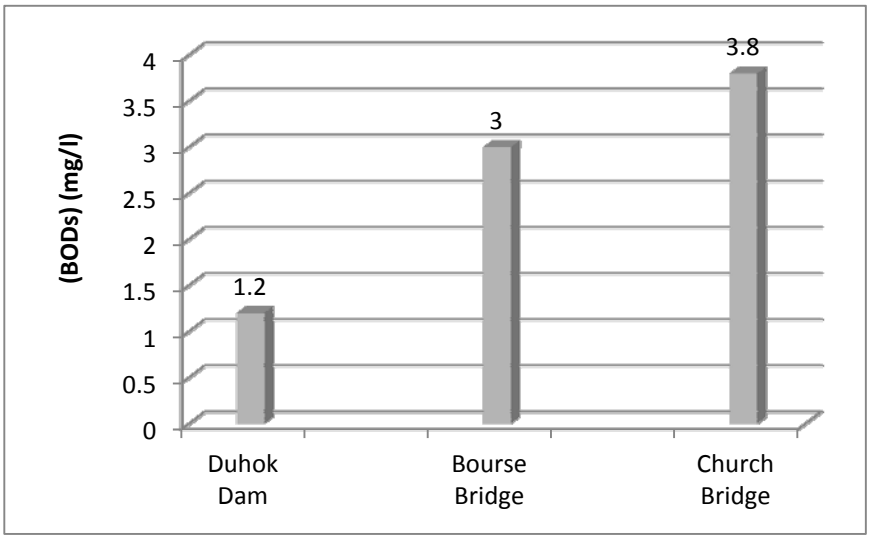

Figure (6): The mean value of (BOD_5) in study locations.

The number of bacterial colonies in water represented in Table 1, the minimum colonies was recorded 53 cells/ml in Dohuk dam location and maximum colonies was 432 cells/ml in Church bridge location. Fig.7 illustrated increasing mean of bacterial colonies through the dam outflow stream to reach 408 cells/ml in Church bridge location as results from the effluents organic materials which help to growth and reproduction of bacteria during to decomposition of deed organisms and this organic materials (Al-Tayyar *et al.*, 2008; Al-Saffawi *et al.*, 2009), also bacteria may be enter from water-legally, accidentally and through illegal dumping (Al-Shawani, 2001; Al-Jahssany, 2003).

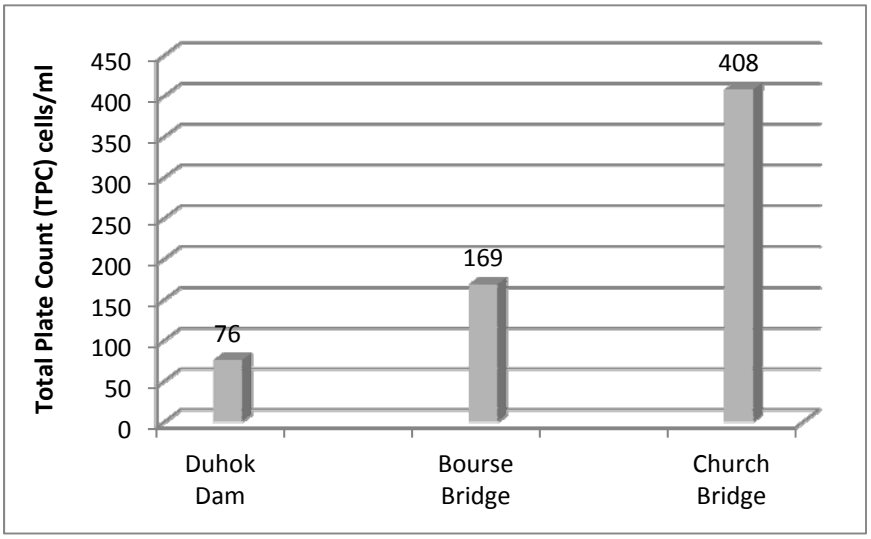

Figure (7): The mean value of bacterial colonies in study locations.

Conclusion

1-The water of Dohuk dam outflow stream recorded high value of (EC) as a result of domestic waste discharge.
2-The total dissolved solids values were above the minimum permissible level of water standard for drinking that recommended by WHO and EPA of 500 mg/l.
3-The water of the Dohuk dam outflow stream was in alkaline side.
4-The water of Dohuk dam outflow stream classified as hard water.
5-Bacterial colonies in the water increasing as results of domestic waste which help growth and reproduction of bacteria.

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لێکولینەك لسەر کوالیتیا ئاڤا ئاڤەرویێن سکرێ دهوك

پوختە:

سکرێ دهوك دکەڤیتە باکورێ پارێزگەها دهوك، کو ئێکە ژ ژێدەرێن سەرەکی بۆ دابینکرنا ئاڤێ بۆ ژمارەکا دەڤەرێن ناف شارێ دهوك بۆ مەرەما ڤەخارنێ و پێتڤیێن روژانە ، ژێدەرێن ئاڤا سکری ژ سەروکانیەکا کانییێت بچیك کوم دبیت هەتا دگەهیتە گەلیێ دهوکێ ناف باژیری هەتا دگەهیتە ناف سکرێ میسل، بۆ ڤێ لێکولینی سێ جھ هاتبونە دەست نیشانکرن ، جهێ ئێکێ ل ژێر نەفەقا سکری، یێ دووێ ل ژێر پرا بورسێ ،و یێ سێیێ ل ژێر پرا کەنیسێ، ئاڤ هاتە وەرگرتن ژ هەیڤا دهە ۲۰۱۰ هەتا هەیڤا دوو ۲۰۱۱ ئامانج ل ڤێ ڤەکولینێ چاڤدێری کرن و دەست نیشانکرنا خسلەتێن فیزیاوی و کیمیاوی و بایلوجی کەرەستێن ئەندامی یێن ئاڤێ بهێنە دەست نیشانکرن و ئاستێ پاقژیا ئاڤێ بۆ بکارئینانێ ژ لایێ هاولاتیا.

ئەنجامێن گەهاندنا کارەبایی و کەرەستێن رەق گەهشتنە ۱۱۱٦ مایکروسیمینز/سم ، ۸۹۹ ملگم/لتر ل دویف ئێك، ئەنجامێ ئوسا هایدروجینی 9.1 پلە تومارکرن ل جهێ پرا بورسێ ، و ئەنجاما دیارکرن کو بەرەف تفتیڤە، و ئنجامێن چراتی گشتی ٦۰۳ملگم/لتر پلە هاتنە تومارکرن ل دویف ئێك جهێ پرا کەنیسێ، ئاڤا ڤان ئاڤەرویێت هاتینە بەحسکرن ریژەکا یا عوسرێ تێدابوو کو بتربوو ژ ۳۰۰ملگم/لتر(WHO) .،(2006

ریژا ئوکسیجینا توێنەر کێمبوو ل ناڤ ئاڤە رویا کەهشتە 6.0ملگم/لتر ل جهی پرا کەنیسێ و ل جهێن دیتر ریژا بایوکیمیاوی یا ئوکسجینێ زێدەبوو بۆ 4.1ملگم/لتر ل جهێ پرا کەنیسێ ژبەر کو پاشماوێت کشتوکالی و روژانە دچنە ناڤ ئاڤەرویادا، هەروەسا ژمارا داگیرکەرێن بەکتیری زێدەبوو بۆ ٤۳۲ خانە بۆ ۱مل ل ئاڤێ ل جهی برا کەنیسێ

پیتێت رێ نیشاندەر : **سکرێ دهوك،جورێ ئاڤێ، چاودێری تایبەتمەندیێن ئاڤێ،پاشماوێت شارستانی.**

دراسة نوعية مياه مجرى سد دهوك

الخلاصة:

يقع سد دهوك الى شمال محافظة دهوك، تعتبرمياه سد دهوك واحدة من المصادر الرئيسية التي تجهز العديد من المناطق داخل المدينة للاغراض المدنية والشرب، تنحدر مياه السد من خلال مجرى صغير وصولا الي مياه وادي دهوك داخل المدينة الذي يصب اخيرا في سد الموصل ،تضمنت الدراسة تحديد ثلاث مواقع من هذا المجرى ،الموقع الاول من اسفل نفق السد ،الثاني من منطقة جسر البورسة والثالث من منطقة جسر الكنيسة، جمعت العينات من شهر تشرين الاول ٢٠١٠ لغاية شهر شباط ٢٠١١ ، يهدف هذا البحث الى مراقبة وتحديد الخصائص الفيزيائية والكيميائية والبايولوجية وقابليتها للاستخدامات البشرية.

وصلت قيم التوصيل الكهربائي والمواد الصلبة الكلية الى ١١١٦ مايكروسيمنز / سم، ٨٩٩ ملغم/لتر وقيمة الاس الهيدروجيني سجلت ٩,١ في محطة جسر البورسة ،اشارت القيم نحو القاعدية، وسجلت قيم العسرة الكلية ٦٠٣ ملغم/لتر في محطة جسر الكنيسة، تعتبر مياه المجرى ذات قساوة حيث جاوزت ٣٠٠ ملغم / لتر (WHO,2006). انخفضت قيم الاوكسجين المذاب خلال جريان الماء للمجرى ليصل الى ٦,٠ ملغم/ لتر في محطة جسر الكنيسة وازدادت قيم المتطلب البايوكيميائي للاوكسجين خلال المجرى ليصل الى ٤,١ ملغم/ لتر في محطة جسر الكنيسة بسبب تدفق الفضلات الزراعية والمدنية،كما ان عدد مستعمرات البكتيرية ازدادت خلال المجرى ليصل الى ٤٣٢ خلية لكل مل في محطة جسر الكنيسة.

الكلمات الدالة : سد دهوك، نوعية المياه، مراقبة خصائص المياه، المتدفقات المدنية.