وزارة التعليم العالي والبحث العلمي
الجامعة التكنولوجية
قسم هندسة البناء والإنشاءات
فرع الهندسة الصحية والبيئية

Biological water Quality of some cities in south of Iraq

مشروع سنوي مقدم الى الجامعة التكنلوجية قسم هندسة البناء والانشاءات فرع الهندسة الصحية

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بسم الله الرحمن الرحيم

" الَّذِي جَعَلَ لَكُمُ الْأَرْضَ فِرَاشًا وَالسَّمَاءَ بِنَاءً وَأَنْزَلَ مِنَ السَّمَاءِ مَاءً فَأَخْرَجَ بِهِ مِنَ الثَّمَرَاتِ رِزْقًا لَكُمْ فَلَا تَجْعَلُوا لِلَّهِ أَنْدَادًا وَأَنْتُمْ تَعْلَمُونَ"

صدق الله العظيم

الآية (22) سورة البقرة

الإهداء

إلى النبع الصافي الذي أرتوي منه حبا وحنانا..... والدتي الحنونة

إلى من زرع واليوم يقطف الثمار ..... والدي العزيز

إلى القلوب الدافئة التي تنخر لي المحبة ..... إخوتي الأعزاء

إلى الشموع التي أضاءت لي طريق العلم ..... أساتذتي الأفاضل

أهدي ثمرة جهدي هذا

شكر وتقدير

أقدم شكري والتقدير العالي إلى الأستاذ الفاضل

(الدكتور فارس حمودي) لما بذله من جهد متميز في أثنائي

بالمعلومات القيمة والعلمية لمساعدتي في أنجاح وانجاز المشروع

السنوي.وكذلك اتقدم بالشكر الجزيل للاستاذ(سامح بدري) لما قدمه

لي من معلومات علمية جيدة..

وشكري وتقديري إلى كافة الأساتذة في قسم هندسة البناء و

الإنشاءات فرع

الهندسة الصحية والبيئية متمنياً من الله إن يوفقهم جميعا خدمة

للإنسانية في تقدم المسيرة العلمية وبناء الوطن .

CHAPTER ONE

INTRODUCTION

Microaorganisms are significant in water because of their roles in disease transmission and in biological treatment processes.

Water, and other water practitioners must have considerable knowledge of the microbiological characteristics of water

Water operators must know what principal groups of microorganisms are typically found in water supplies (surface and groundwater)

They must be able to identify those microorganisms that must be treated (pathogenic organisms) and be removed or controlled for biological treatment processes.

They must also be able to identify the organisms used as indicators of pollution/contamination and know their significance, and they must know the methods used to enumerate the indicator organisms.

In order to have microbiological activity the body of water must possess the appropriate environmental conditions. the conditions required for aerobic operation are

(1) Sufficient free, elemental oxygen.

(2) Sufficient organic matter (food).

(3) Sufficient water.

(4) Enough nitrogen and phosphorus (nutrients) to permit oxidation of the available carbon materials.

THE OBJECTIVE OF THE PROJECT

1.Study pictrologip raw water in water sources to some area of southen Iraq and the statement of their suitability for use in many areas such as drinking , irrigation and other uses.

2.Showing various parameters in the from of relation drawn and tables prepared for that purpose.

3.Discuss the results and various relationships between the different elements and make recommendations on the validity of water.

CHPTER TWO

MICROBIOLOGY: WHAT IS IT?

Microbiology is a branch of biology that deals with the study of microorganisms so small in size that they must be studied under a microscope.
Microorganisms of interest to the water operator include bacteria, protozoa, viruses, algae, and a few others.

The science and study of bacteria is known as bacteriology.
microorganisms that cause waterborne diseases — waterborne pathogens — to protect the consumer (human and animal).
water operator, in regards to its reliance on knowledge of microbiological principles, is described in the following:

1. Water operators are concerned with water supply and water purification through a treatment process.

In treating water, the primary concern is producing potable water that is safe to drink (free of pathogens) with no accompanying offensive characteristics such as foul taste and odor. The treatment operator must possess a wide range of knowledge in order to correctly examine water for pathogenic microorganisms and to determine the type of treatment necessary to ensure the water quality of the end product, potable water, meets regulatory requirements.

2. As mentioned, wastewater operators are also concerned with water quality.

MICROORGANISMS (IN GENERAL)

The microorganisms we are concerned with are tiny organisms that make up a large and diverse group of free-living forms; they exist either as single cell, cell bunches, or clusters. Found in abundance almost anywhere on earth, the vast majority of microorganisms are not harmful. Many microorganisms, or microbes, occur as single cells (unicellular). Others are multicellular; and others, viruses, do not have a true cellular appearance.

For the most part, a single microbial cell exhibits the characteristic features common to other biological systems, such as metabolism, reproduction, and growth.

Bacteria

Single-cell, microscopic living organisms (single-celled microorganisms) that possess rigid cell walls. They may be aerobic, anaerobic, or facultative; they can cause disease; and some are important in pollution control.

Bio-geo-chemical cycle

The chemical interactions among the atmosphere, hydrosphere, and biosphere.

Coli form organism

Microorganisms found in the intestinal tract of humans and animals. Their presence in water indicates fecal pollution and potentially adverse contamination by pathogens.

Fungi

Simple plants lacking that ability to produce energy through photosynthesis.

Fungi are of relatively minor importance in water operations (except for bios lids composting, where they are critical). Fungi, like bacteria, are also extremely diverse. They are multicellular, autotrophic, photosynthetic protests. They grow as filamentous, mold-like forms or as yeast-like (single-celled) organisms. They feed inorganic material. Aquatic fungi grow as parasites on living plants or animals and as saprophytes on those that are dead.

(Hans-Joachim.et.al,2005)

WHAT IS BACTERIA?

The word bacteria (singular: bacterium) comes from the reek word meaning rod or staff, a shape characteristic many bacteria. Recall that bacteria are single-celled

microscopic organisms that multiply by splitting in two binary fission). In order to multiply they need carbon oxide if they are autographs, and need organic compounds
(dead vegetation, meat, sewage) if they are heterotrophy. heir energy comes either from sunlight if they are photosynthetic r from chemical reaction if they are chemosynthetic. bacteria are present in air, water, earth, rotting vegetation, and the intestines of animals. Human and animal asters are the primary source of bacteria in water.
These sources of bacterial contamination include runoff room feedlots, pastures, dog runs, and other land areas here animal wastes are deposited. Additional sources include seepage or discharge from septic tanks and sewage treatment facilities. Bacteria from these sources can enter ells that are either open at the land surface or do not have watertight casings or caps. Gastrointestinal disorders are common symptoms of most diseases transmitted by waterborne autogenic bacteria.

STRUCTURE OF THE BATERIAL Cell

The structural form and various components of the bacterial cell are probably best understood by referring to the simplified diagram of a rod-form bacterium shown in (that cells of different species may differ greatly, both in structure and chemical composition; for this reason no typical bacterium exists.

Capsules

Bacterial capsules(see figure .1) are organized accumulations of gelatinous materials on cell walls, in contrast to slime layers (a water secretion that adheres loosely to the cell wall and commonly diffuses into the cell), which are unorganized accumulations of similar material.
The capsule is usually thick enough to be seen under the ordinary light microscope (microcapsule), while thinner capsules (microcapsules) can be detected only by electron microscopy.

The production of capsules is determined largely by genetics as well as environmental conditions, and depends on the presence or absence of Capsule-degrading enzymes and other growth factors. Varying in composition, capsules are mainly composed of water; the organic contents are made up of complex polysaccharides, nitrogen-containing substance, and polypeptides. Capsules confer several advantages when bacteria grow in their normal habitat. These include helping to:

1. Prevent desiccation
2. Resist phagocytosis by host phagocyte cells
3. Prevent infection by bateriophages
4. Aid bacterial attachment to tissue surfaces in plant and animal hosts or to surfaces of solids objects in aquatic environments

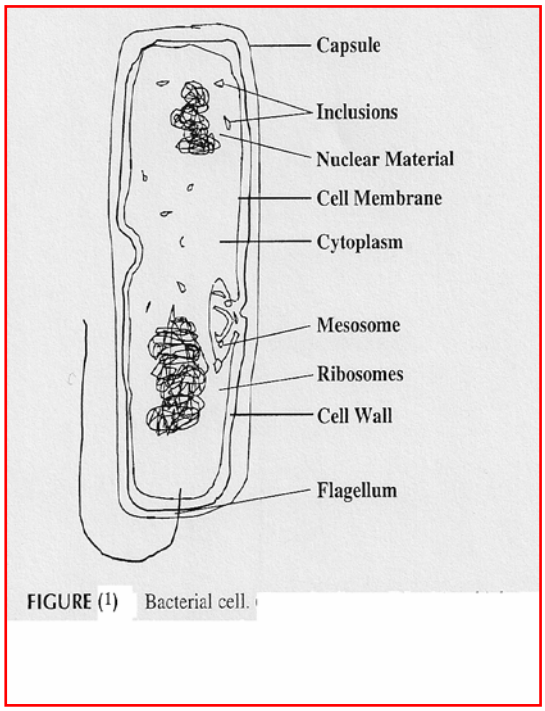

FIGURE (1) Bacterial cell.

(Louis Theodore ,et. 2002)

WATERBORNE BACTERIA

all surface waters contain bacteria. Waterborne bacteria, as we have said, are responsible for infectious epidemic diseases.

Bacterial numbers increase significantly during storm events when streams are high. Heavy rainstorms increase stream contamination by washing material from the ground surface into the stream. After the initial washing occurs, few impurities are left to be washed into the stream, which may then carry relatively clean water. A river or stream of good water quality shows its highest bacterial numbers during rainy periods; a much-polluted stream may show the highest numbers during low flows because of the constant influx of pollutants and decreased dilution ability.

Water operators are primarily concerned with bacterial pathogens responsible for disease. These pathogens enter potential drinking water supplies

through fecal contamination and are ingested by humans if the water is not properly treated and disinfected.

THE WATERBORNE DISEASES

The three protozoa and the waterborne diseases associated with them of most concern to the waterworks operator are:

1. *Endameba histolytic* — amoebic dysentery
2. *Guardia lamblia* — giardiasis
3. *Cryptosporidium* — cryptosporidiosis

In wastewater treatment, protozoa are a critical part of the purification process and can be used to indicate the condition of treatment processes. Protozoa normally associated with wastewater include amoeba, flagellates, free swimming ciliates, and stalked ciliates.

Amoebas are associated with poor wastewater treatment of a young bios lids mass (see Figure 3). They move through wastewater by a streaming or gliding motion. Moving the liquids stored within the cell wall effects this movement. They are normally associated with an effluent high in biochemical oxygen demands (BODs)
and suspended solids.

Flagellates (flagellated protozoa) have a single, long hair-like or whip-like projection (flagella) that is used to propel the free-swimming organisms through wastewater
and to attract food (see Figure 3). Flagellated protozoa are normally associated with poor treatment and a young bios lids age. When the predominate organism is the flagellated protozoa, the plant effluent will contain large amounts of BODs and suspended solids

The free-swimming ciliated protozoan uses its tiny, hair-like projections (cilia) to move itself through the wastewater and to attract food (see Figure 3). The free swimming ciliated protozoan is normally associated

with a moderate biosolids age and effluent quality. When the free-swimming ciliated protozoan is the predominate organism, the plant effluent will normally be turbid and contain a high amount of suspended solids.

The stalked ciliated protozoan attaches itself to the wastewater solids and uses its cilia to attract food (see Figure 3). The stalked ciliated protozoan is normally associated with a plant effluent that is very clear and contains low amounts of both BODs and suspended solids.

Rotifers make up a well-defined group of the smallest, simplest multicellular microorganisms and are found in nearly all aquatic habitats (see Figure 4). Rotifers are a higher life form associated with cleaner waters. Normally found in well-operated wastewater treatment plants, they can be used to indicate the performance of certain types of treatment processes.

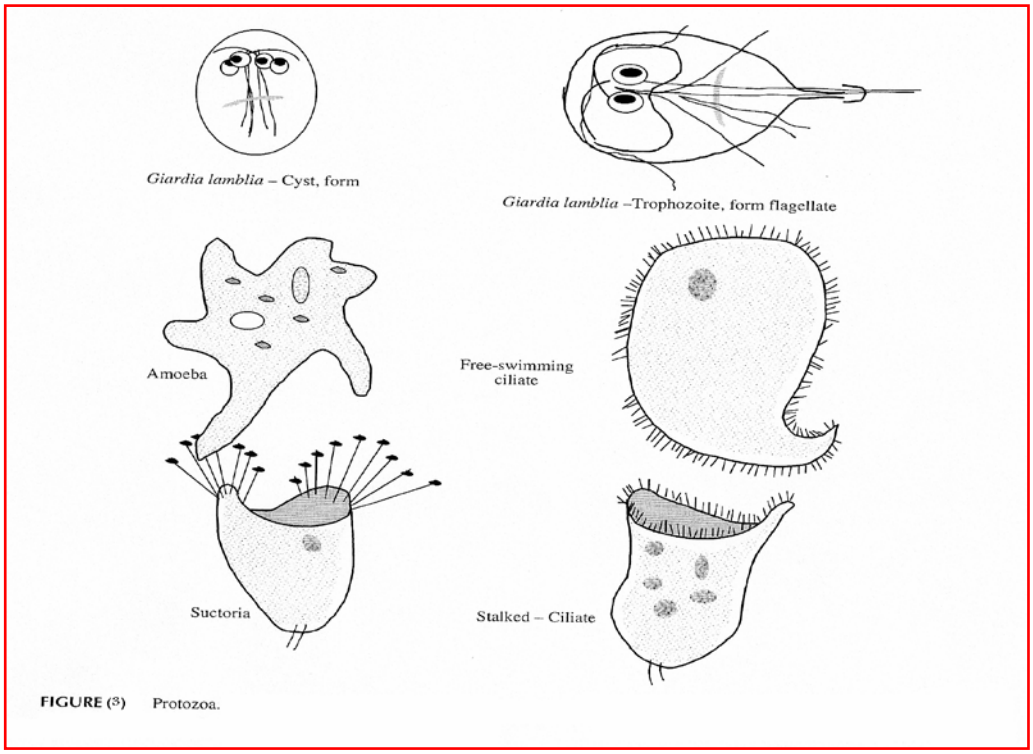

FIGURE (3) Protozoa.

(National Research council,2001)

BACTERIAL GROWTH FACTORS

Several factors affect the rate at which bacteria grow, including temperature, pH, and oxygen levels. The warmer the environment, the faster the rate of growth. Generally,
for each increase of 10°C, the growth rate doubles. Heat can also be used to kill bacteria.

Most bacteria grow best at neutral pH. Extreme acidic or basic conditions generally inhibit growth, though some bacteria may require acidic and some require alkaline conditions for growth. Bacteria are aerobic, anaerobic, or facultative. If aerobic, they require free oxygen in the aquatic environment. Anaerobic bacteria exist and multiply in environments that lack dissolved oxygen (DO). Facultative bacteria can switch from an aerobic to anaerobic growth or grow in an anaerobic or aerobic environment. Under optimum conditions, bacteria grow and reproduce very rapidly. As stated previously, bacteria reproduce by binary fission.
An important point to consider in connection with bacterial reproduction is the rate at which the process can occur. The total time required for an organism to reproduce and the offspring to reach maturity is called generation time. Bacteria growing under optimal conditions can double their number about every 20 to 30 min. obviously; this generation time is very short compared to that of higher plants and animals. Bacteria continue to grow at this rapid rate as long as nutrients hold out — even the smallest contamination can result in a sizable growth in a very short time.

Flagella

Many bacteria are motile, and this ability to move independently is usually attributed to a special structure, the flagella (singular: flagellum). Depending on species, a cell may have a single flagellum (see Figure 1) (mono tritons bacteria; tricots means hair); one flagellum at each end (amphitrichous bacteria; amphi means on both sides); a tuft of flagella at one or both ends (lophotrichous bacteria; loophole means tuft); or flagella that arise all over the cell surface (peritrichous bacteria; peril means around).

A flagellum is a threadlike appendage extending outward from the plasma membrane and cell wall. Flagella are slender, rigid, and measure About 20 μm across and up to 15 to 20 μm long.

Flagellation patterns are very useful in identifying bacteria and can be seen by light microscopy, but only after being stained with special techniques designed to
Increase their thickness. The detailed structure of flagella can be seen only in the electron microscope.

Bacterial cells benefit from flagella in several ways. They can increase the concentration of nutrients or decrease the concentration of toxic materials near the bacterial surfaces by causing a change in the flow rate of fluids. They can also disperse flagellated organisms to areas where colony formation can take place. The main benefit of flagella to organisms is their increased ability to flee from areas that might be harmful.

E. coli

The first documented case of waterborne disease outbreaks in the U.S. associated with enter pathogenic *E. coli* occurred in the 1960s. Various serotypes of *E. coli* Have been implicated as the etiological agent responsible for disease in newborn infants, usually the result of cross contamination in nurseries. Now, there have been several well-documented outbreaks of *E. coli* associated with adult waterborne disease. similar to *E. coli, Guardia lamblia* was first identified in the 1960s to be associated with waterborne outbreaks in the United States. Recall that *Guardia lamblia* is a flagellated protozoan that is responsible for giardiasis, a disease that can range from being mildly to extremely debilitating. Guardia is currently one of the most commonly identified pathogens responsible for waterborne disease outbreaks. The life cycle of Guardia includes a cyst stage when the organism remains dormant and is extremely resilient (i.e., the cyst can survive some extreme environmental conditions).

Once ingested by a warm-blooded animal, the life cycle of giardia continues with excitation. The cysts are relatively large (8 to 14 μm) and can be removed effectively by filtration using diatomaceous earth, granular media, or membranes.

Giardiasis can be acquired by ingesting viable cysts from food or water or by direct contact with fecal material. In addition to humans, wild and domestic animals have been implicated as hosts. Between 1972 and 1981, 50 waterborne outbreaks of giardiasis occurred with about 20,000 reported cases. Currently, no simple and reliable method exists to assay Guardia cysts in water samples.

(Jamie Bartram.et,1996)


CHAPTER THREE

Results and Dissection

The analysis of different important biological Tigris river characteristics of raw water in some location in south of Iraq is conducted at different month for the period of (2005-2007). The result are shown below :

1. Al-Kutt city

   Figure.1 shows the BOD values at Al-Kutt city. Each point in figure represent monthly value (one sample at each month) . Figure.2 shows the plate count values . The total coli form bacteria is shown in figure.3, and total E-coli is shown in figure.4 .

   The values of BOD ranged from (0.137 - 5.7) , and from these figure it can be concluded that the quality of Tigris River is good because the values of BOD were not high also the value of plate count , coli form and total E-coli compared with Iraqi standers . Although there were some number of bacteria but these were not so high and can be removed using disinter if the water used for drinking.

2. Shatt –Al-Arab

   The BOD values of Shatt-Al-Arab is shown in figure.1.Each point in figure represent monthly value. The values of BOD ranged from (0.22) to (7.5), the maximum value of BOD for Shatt-al-Arab is

high , that it can be concluded the quality of Tigris River is not good in that location. The values of plate count is shown in figure.2 and the values of coli form is shown in figure.3,and figure.4 shows the total E-coli. The values of these were not high because it is compared with Iraqi standers.

3. Al-Amara city

Figure.1 shown the BOD values ,that values ranged from (0.137–4.69)

It is not high ,although the quality of Tigris is good .In figure.2 is shows the plate count values ,and figure.3 is shows number of coli form bacteria ,and the total E-coli values is shown in figure.4,but these values were high because the values ranged from(130) to(566)

The number of bacteria is high ,but we can be removed and use the water in drinking.

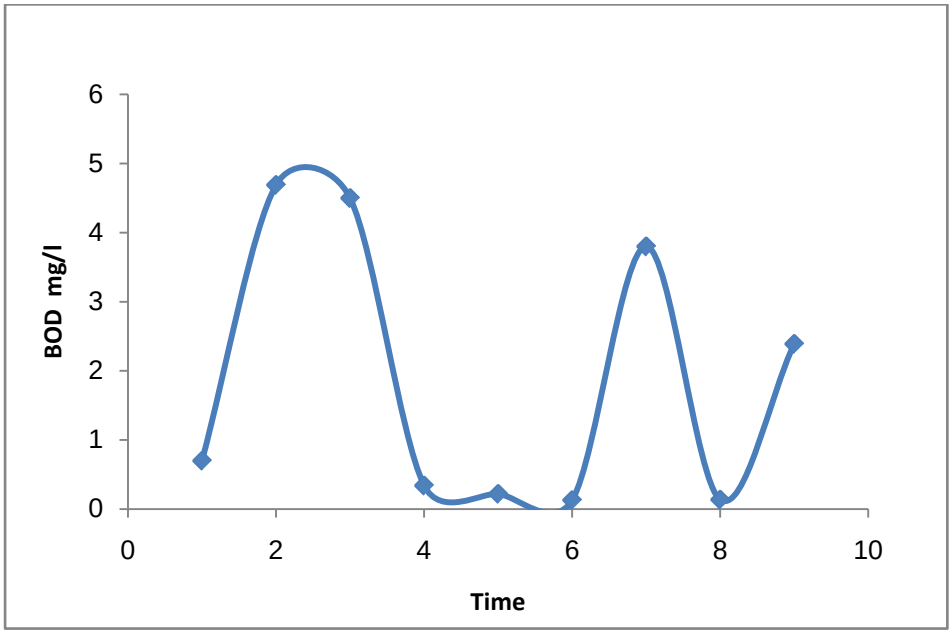

Fig.1 BOD values for Al-Amara at different time

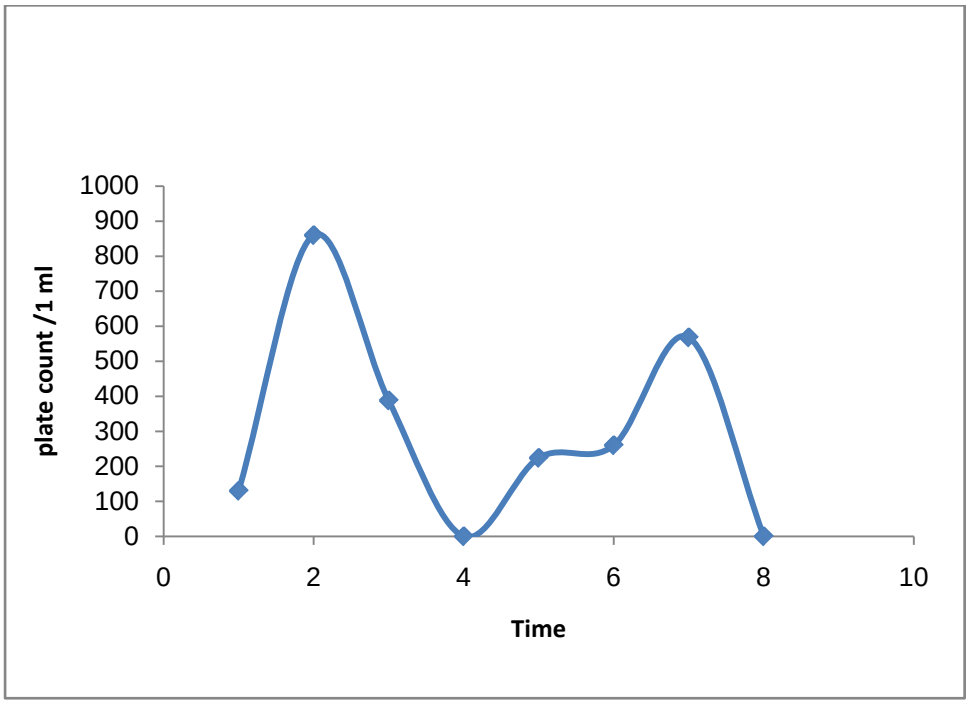

Fig.2 Plate count values for Al-Amara at different time

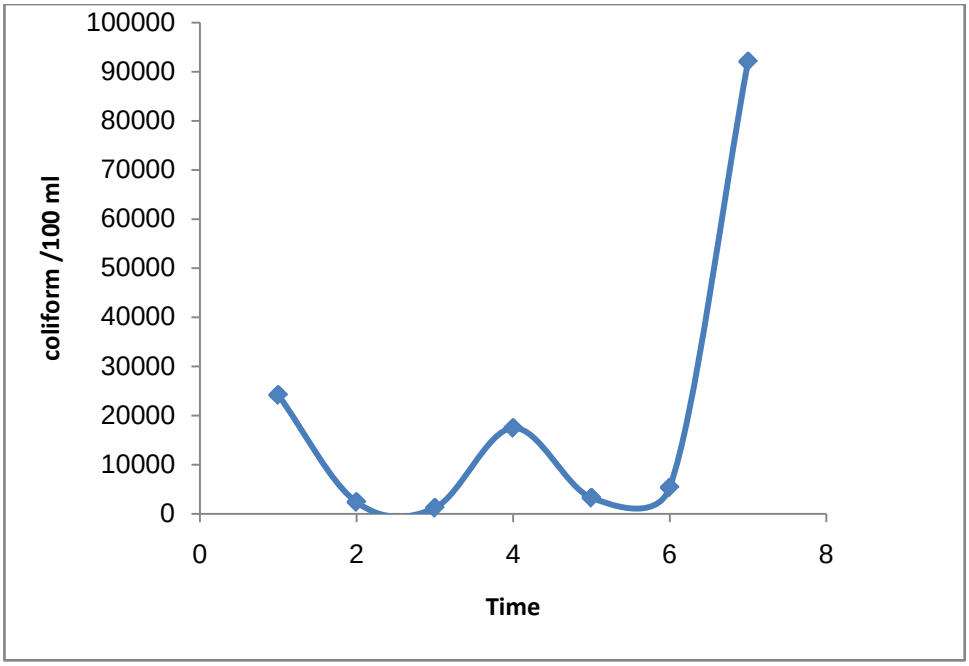

Fig.3 Coli form values for Al-Amara different time

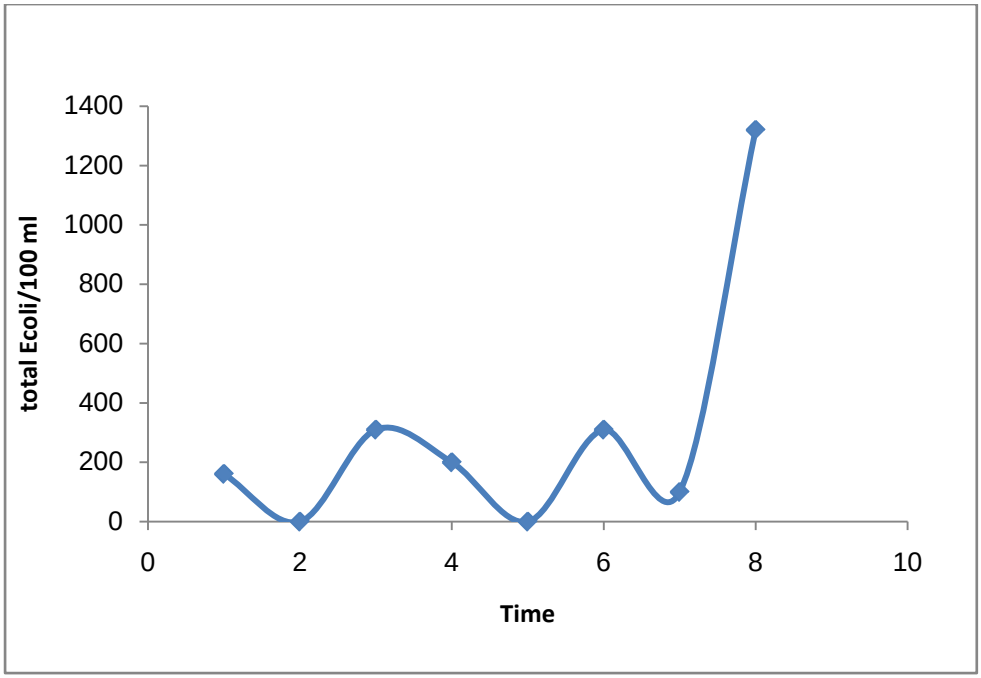

Fig.4 Total E-coli values for Al-Amara at different time

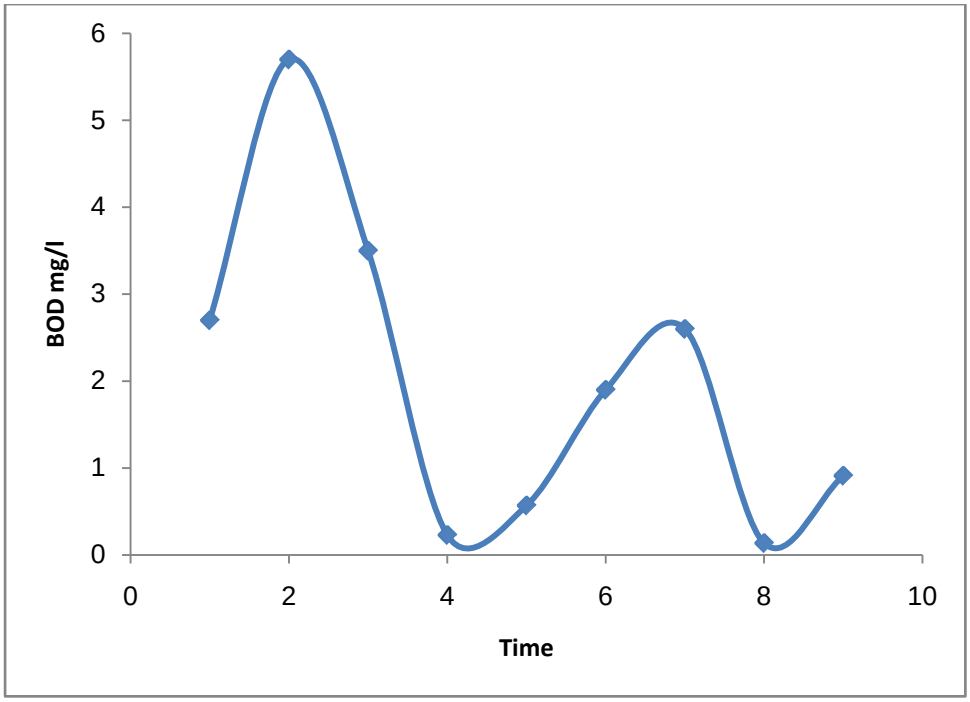

Fig.1 BOD values for Al-Kutt at different time

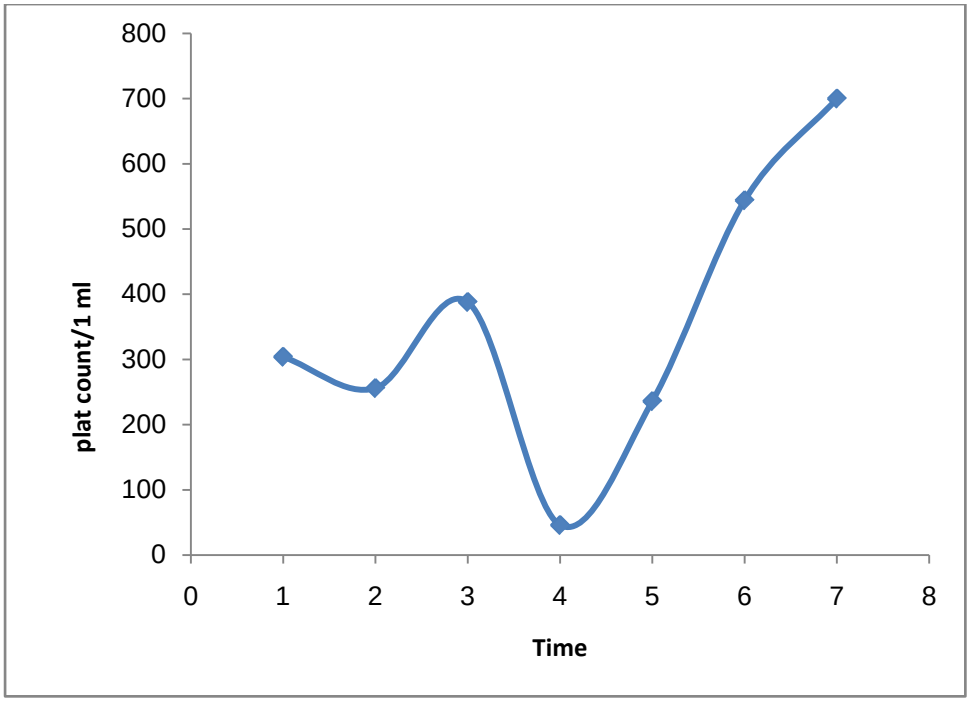

Fig.2 Plate count values for Al-Kutt at different time

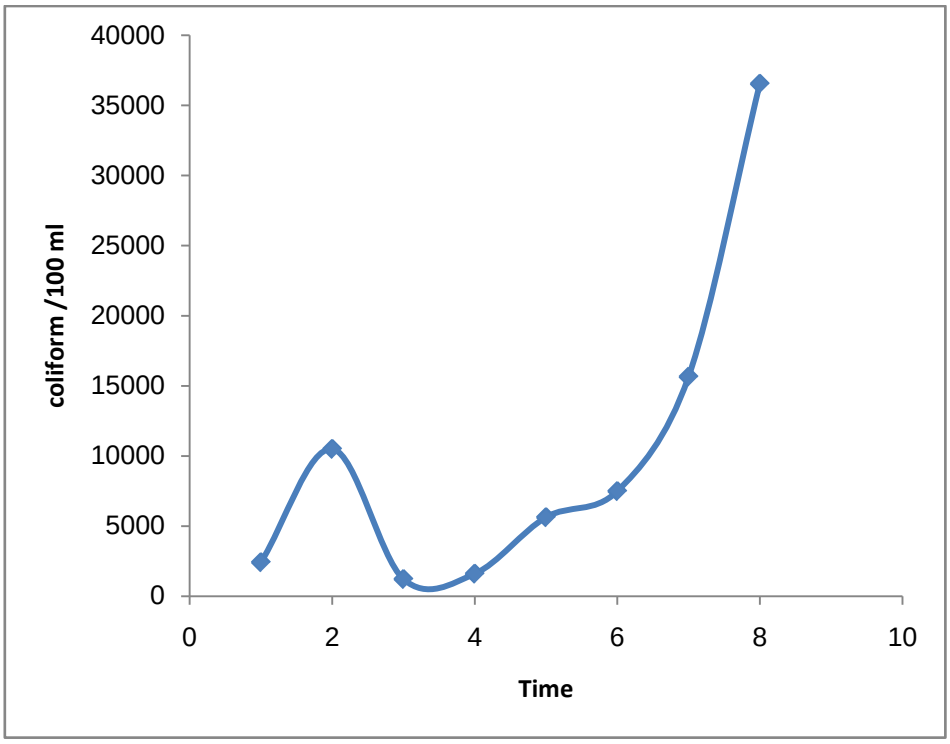

Fig.3 Coli form values for Al-Kutt at different time

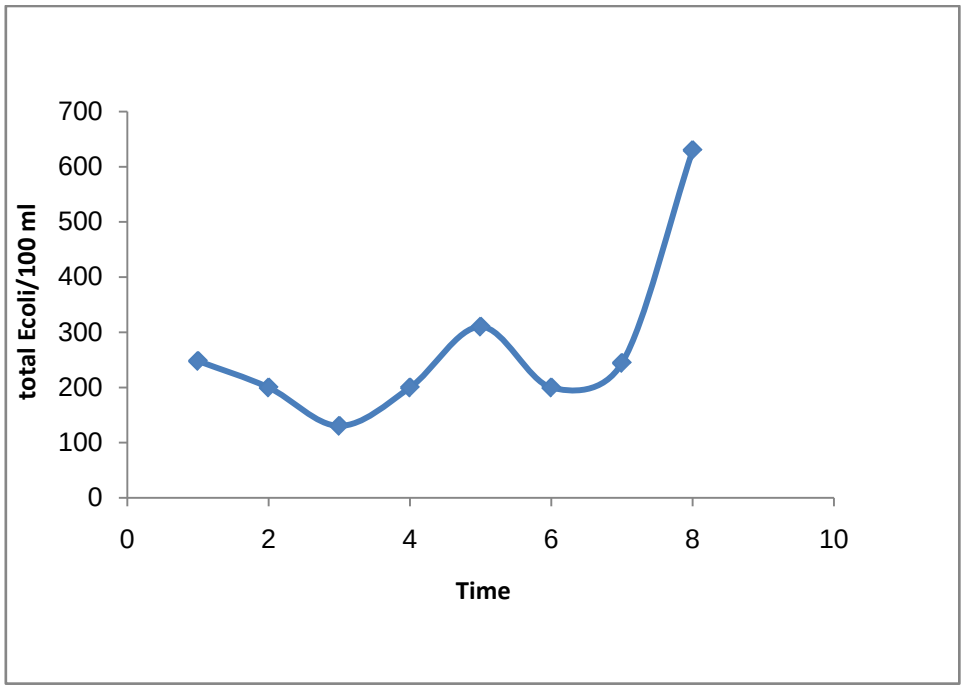

Fig.4 Total E-coli values for Al-Kutt different time

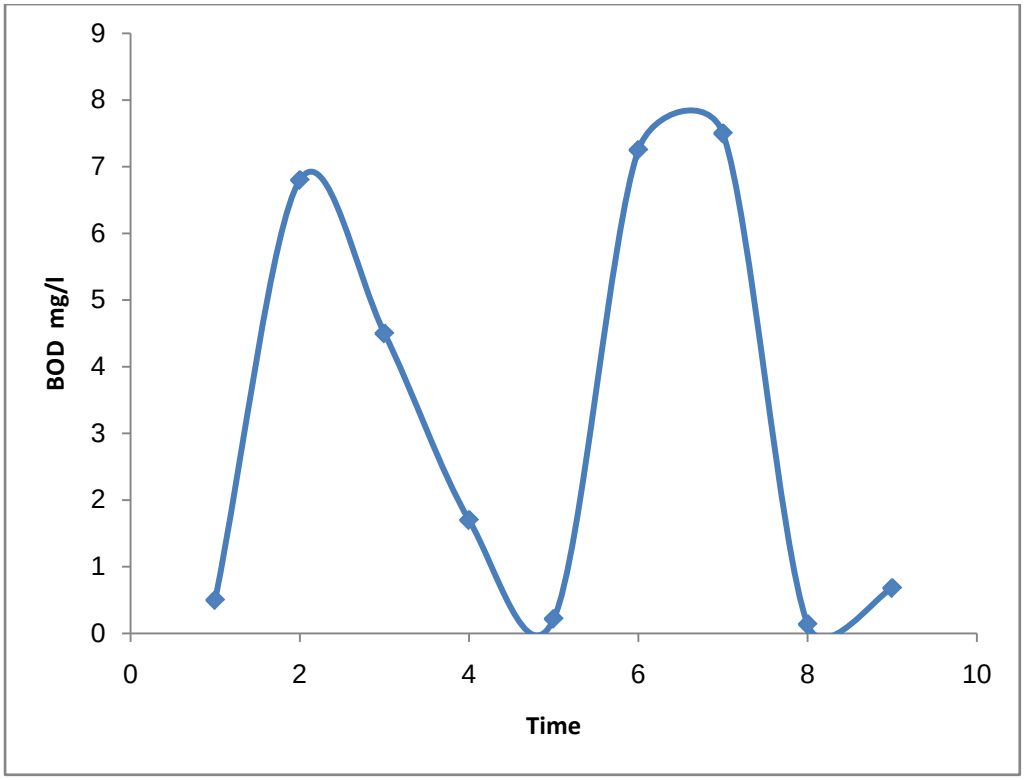

Fig.1 BOD values for Shatt-Al-Arab at different time

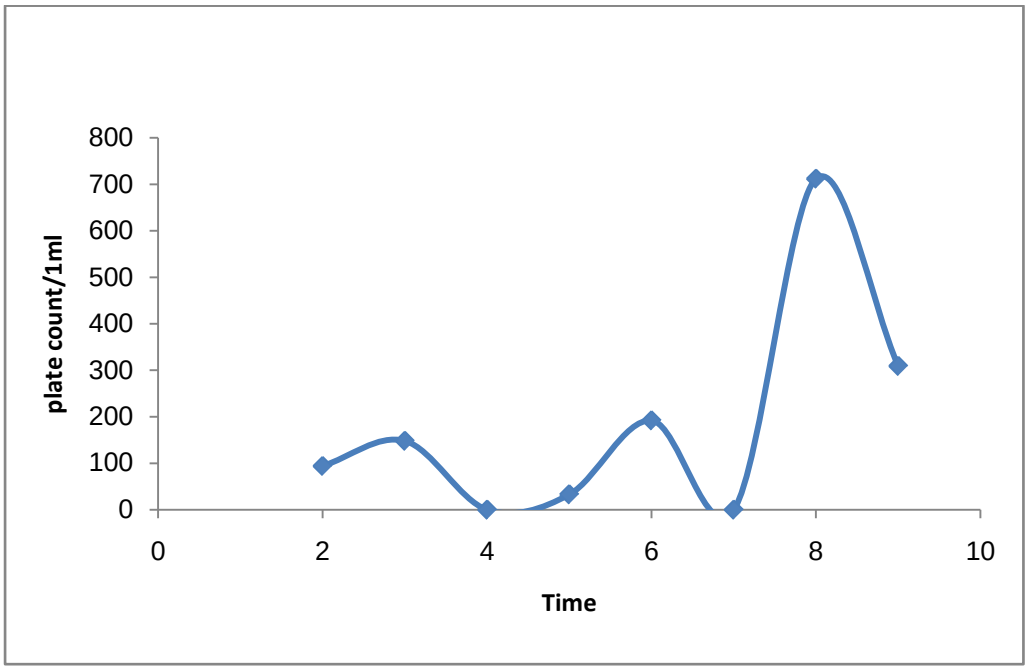

Fig.2 Plate count values for Shatt-Al-Arab at different time

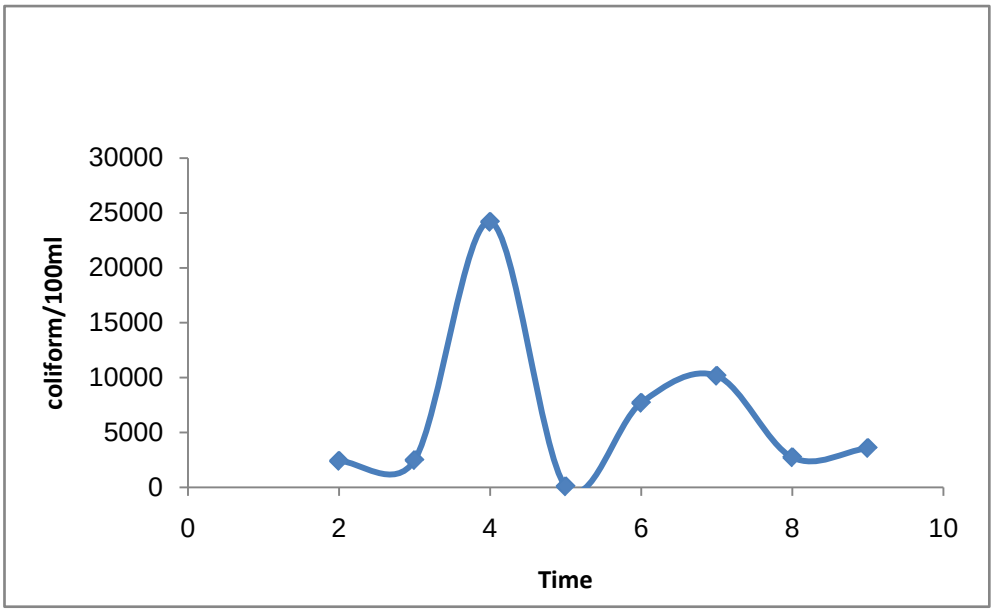

Fig.3 Coli form values for Shatt-Al-Arab at different time

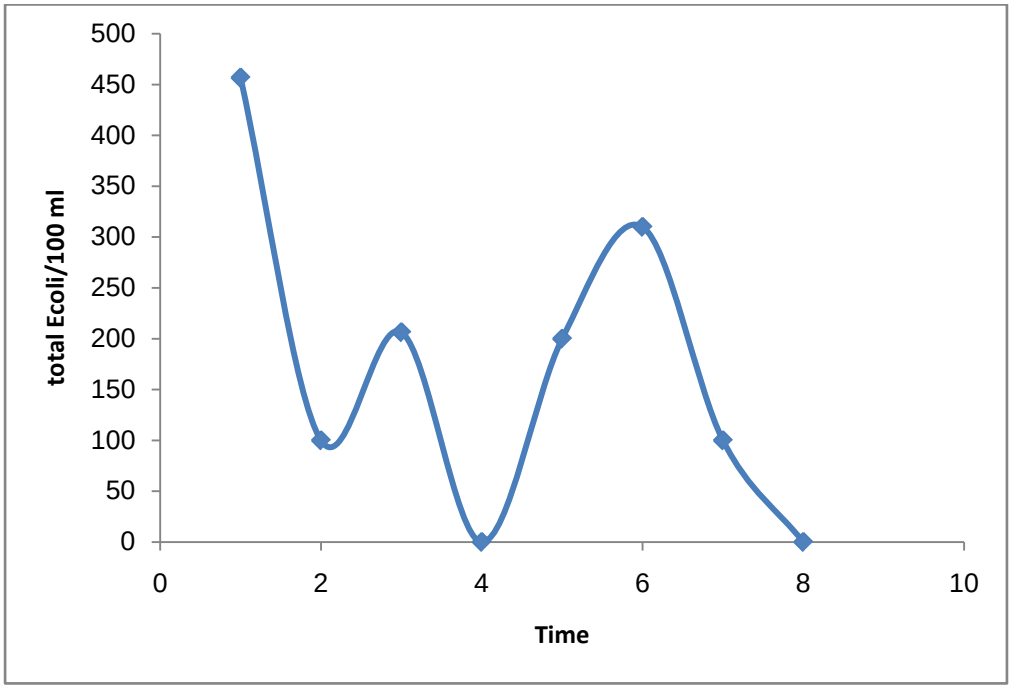

Fig.4 Total E-coli values for Shatt-Al-Arab at different time

CHAPTER FOUR

CONCLSION

From the study results, the following conclusion is shown below:

1.The quality of Tigris river at Al- Kutt city is butter than Shatt-al-Arab and al-Amara city because the reading BOD are low.

2.the reading BOD in Shatt-al-Arab for Tigris river were high, although, we can saw that quality for Tigris river is bad with reference to the reading BOD.

3.From through teasting for plate count for three source in Tigris river (Shatt-al-Arab, al-Kutt city and al-Amaara city), detection that the reading plate count for al-Kutt city are lowest average for the reading with reference to remainder source ,that is the water quality for Tigris river in this location is butter.

4.From through study the reading coli form for three source ,detection that al-Kutt city she was lowest in the reading and that is the quality for Tigris river in this source is butter with refernce to remainder soures.

5.The water quality for Tigris rivre in al-Kutt city is butter becouse the reading for total E-coli are good and according to Iraqi standerd.

6.From through to study all the reading and the teasting which are perfrom for Tigris river to three source (Shatt-al-arab, al-Kutt city and al-amara city) that can be used for drinking water after conventional treatment.

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