International Journal of Earth, Energy and Environmental Sciences
ISSN: 2517-942X
Vol:5, No:12, 2011

Assessment of Water Pollution of Kowsar Dam Reservoir

Mohammad Mahdi Jabbari and Fardin Boustani

Abstract**—**The reservoir of Kowsar dam supply water for different usages such as aquaculture farms , drinking, agricultural and industrial usages for some provinces in south of Iran. The Kowsar dam is located next to the city of Dehdashat in Kohgiluye and Boyerahmad province in southern Iran. There are some towns and villages on the Kowsar dam watersheds, which Dehdasht and Choram are the most important and populated twons in this area, which can to be sources of pollution for water reservoir of the Kowsar dam . This study was done to determine of water pollution of the Kowsar dam reservoir which is one of the most important water resources of Kohkiloye and Boyerahmad and Bushehr provinces in south-west Iran. In this study , water samples during 12 months were collected to examine Biochemical Oxygen Demand (BOD) and Dissolved Oxygen(DO) as a criterion for evaluation of water pollution of the reservoir. In summary ,the study has shown Maximum, average and minimum levels of BOD have observed 25.9 ,9.15 and 2.3 mg/L respectively and statistical parameters of data such as standard deviation , variance and skewness have calculated 7.88, 62 and 1.54 respectively. Finally the results were compared with Iranian national standards. Among the analyzed samples, as the maximum value of BOD (25.9 mg/L) was observed at the May 2010 , was within the maximum admissible limits by the Iranian standards.

Keywords**—**Kowsar dam, Biochemical Oxygen Demand, water pollution

I. INTRODUCTION

A high standard of living involves a high demand for water and, at the same time, causes much greater pollution of this essential element for life. Unsafe drinking water and poor environmental sanitation cause major health problem to the community. Safe drinking water must be free from bacteriological and chemical contamination. The resultant interference in the natural cycle can often overwhelm natural processes of recovery, so that, in addition to products arising from the decomposition of natural substances (e.g., proteins, greases, carbohydrates) there is a build-up of anthropogenous additives such as pesticides, effluents and garbage, which contaminate drinking water supplies with their toxic or hormonal effects. They may also consume such large quantities of oxygen that water resources become fouled. To prevent the threat of possible danger to health, or the very existence of certain species, it is essential to determine the quality of a water source before water is drawn off for consumption .On the basis of the BODn value, assertions may be made both with regard to the characteristics of a water-source and the biological activity of the incubated microflora[1].

The quality of freshwater at any point on the landscape reflects the combined effects of many processes along water pathways. Human activities on all spatial scales affect both water quality and quantity[1].Hydro geological and biophysical environments are directly affected by changes in land use and socioeconomic processes, which are largely controlled by human activities and resource management. A land management decision is a water resource decision, a fundamental concept for addressing and implementing integrated land and water resources management [2].The fastest growing food production sector in the world is aquaculture, the farming of aquatic organisms such as fish, mollusks, crustaceans and plants [3] , while their effect on the sustainable environment is not assured. When effluent of aquaculture farms releases to the river ,the amount of dissolved oxygen will be dropped and sedentary animals may die in water. Antibiotics and other curative chemicals added to feed can affect on organisms for which they were not intended when the drugs are released as the uneaten pellets decompose[4].However, many drugs used in fish farms have been found to have minimal harmful effects on the aquatic ecosystem[5].

Natural water quality varies markedly and is affected by the geology, biology, and hydro climatic characteristics of an area [6]. Even under natural conditions, water may be toxic or otherwise unfit for human consumption. The occurrence of high and toxic metal concentrations is not uncommon and can be attributed to weathering of naturally occurring ore deposits. Although generally non-toxic, the solute concentrations of "pure" bottled spring water can vary by several orders of magnitude worldwide. However, the concept of pollution is relative, in that it reflects a change from some reference value to a value that causes problems for human use [7]. A worldwide reference value is difficult to establish because insufficient monitoring has occurred prior to changes in water quality due to human activities. Furthermore, there is no universal reference of natural water quality because of the high variability in the chemical quality of natural waters [7].Natural water quality variations occur over a wide range of time scales [7].

II. MATERIALS AND METHODS

In order to evaluation of water quality of the Kowsar dam water sampling were done with monthly duration on the

Mohammad Mahdi Jabbari is academic member of Science and Research Branch ,Islamic Azad University, Fars, Iran(mmjabbari@yahoo.com)
Fardin Boustani is, assistant professor of Science and Research Branch ,Islamic Azad University, Fars, Iran (fardinboustani@gmail.com).

Kowsar dam reservoir as have been shown in figure no.1. The dam will supply water to the Persian Gulf littoral cities and ports for nearly 20 years. It will offer water to 2.4 million habitants in south of Iran. Kowsar Dam will flow 70 million cubic meters of water to farmlands in Lishter, Boneh and Zeidoun deserts. The dam can hold 684 million cubic meters of water per annum.

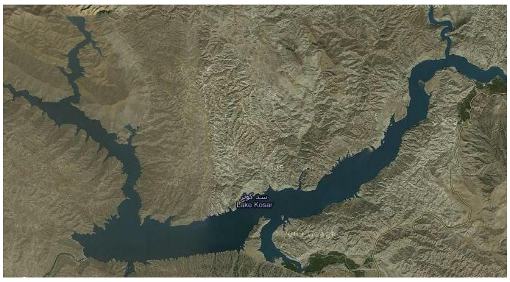

Fig. 1 Reservoir of the Kowsar dam in south of Iran

At first based on site visit and field evaluation, location of the station were selected on the reservoir ,then research team were taken the water samples with field observation and surveying. Finally water quality parameters contain BOD and DO as follow as were evaluated.

Dissolved oxygen

All aquatic animals need dissolved oxygen, so it is vital to the health of aquatic ecosystems. Waterways with consistently high dissolved oxygen levels are most likely healthy and stable environments, and are capable of supporting a diversity of aquatic organisms. Oxygen enters water through photosynthesis of aquatic plants and from the atmosphere. Stream riffles and waves put more water in contact with the atmosphere and thereby increase the amount of oxygen in water. Dissolved oxygen percent saturation is an important measurement of water quality. Cold water can hold more dissolved oxygen than warm water.

Dissolved oxygen (DO) concentration can be measured in lakes and streams using a portable DO meter. We will use the meters from the Environmental Engineering lab for our measurements of Rowan Pond. The meters indicate the concentration of dissolved oxygen in mg/L, as well as in units of percent of saturation.

Water quality in rivers, lakes, and the oceans is affected by the concentrations of dissolved gasses in the water. For example, if there is too little dissolved oxygen in a river, then aquatic life such as fish can die, and the river may have odor problems. At the other end of the spectrum, too much dissolved nitrogen can also be harmful to organisms such as fish. Thus, there is a range of dissolved oxygen concentrations that define an acceptable level of water quality. In general, dissolved oxygen concentrations in the range of 6 to 12 mg/L are adequate for fish to survive[7].

Microorganisms such as bacteria are responsible for decomposing organic waste. When organic matter such as dead plants, leaves, grass clippings, manure, sewage, or even food waste is present in a water supply, the bacteria will begin the process of breaking down this waste. When this happens, much of the available dissolved oxygen is consumed by aerobic bacteria, robbing other aquatic organisms of the oxygen they need to live.

Biological Oxygen Demand (BOD)

The BOD is the amount of oxygen consumed by bacteria in the decomposition of organic material. It also includes the oxygen required for the oxidation of various chemical in the water, such as sulfides, ferrous iron and ammonia. While a dissolved oxygen test tells you how much oxygen is available, a BOD test tells you how much oxygen is being consumed. BOD is determined by measuring the dissolved oxygen level in a freshly collected sample and comparing it to the dissolved oxygen level in a sample that was collected at the same time but incubated under specific conditions for a certain number of days. The difference in the oxygen readings between the two samples in the BOD is recorded in units of mg/L. The sample must be representative and handled carefully. No matter how accurate the actual testing is, if the sample is not representative, the results of the test will not reflect actual conditions and can lead to poor plant performance.

Biological Oxygen Demand (BOD) is a measure of the oxygen used by microorganisms to decompose this waste. If there is a large quantity of organic waste in the water supply, there will also be a lot of bacteria present working to decompose this waste. In this case, the demand for oxygen will be high (due to all the bacteria) so the BOD level will be high. As the waste is consumed or dispersed through the water, BOD levels will begin to decline.

The BOD test takes 5 days to complete and is performed using a dissolved oxygen test kit. The BOD level is determined by comparing the DO level of a water sample taken immediately with the DO level of a water sample that has been incubated in a dark location for 5 days. The difference between the two DO levels represents the amount of oxygen required for the decomposition of any organic material in the sample and is a good approximation of the BOD level.

1. Take 2 samples of water
2. Record the DO level (ppm) of one immediately using the method described in the dissolved oxygen test.
3. Place the second water sample in an incubator in complete darkness at 20 °C for 5 days. If you don't have an incubator, wrap the water sample bottle in aluminum foil or black electrical tape and store in a dark place at room temperature (20 °C or 68 °F).
4. After 5 days, take another dissolved oxygen reading (ppm) using the dissolved oxygen test kit.
5. Subtract the Day 5 reading from the Day 1 reading to determine the BOD level. Record your final BOD result in ppm.http://www.k12science.org/curriculum/dipproj2/en/fieldbook/bod.shtml

The dissolved oxygen determination requires a grab sample. The sample must be analyzed as quickly as possible. Select a sampling location where mixing is thorough and the wastewater quality is uniform. The higher the amount of solids in the sample, the more important a well mixed sample becomes. If testing is not done on an hourly basis, choose times when the sample best represents the waste characteristics so that changes can be spotted quickly.

Since variations will occur from plant to plant and with the time of day, it is necessary to develop a testing program which gives the most accurate representation of the characteristics of the flow.

The Biochemical Oxygen Demand (or BOD) is a measure of the amount of food for bacteria that is found in water. It determines the strength in terms of oxygen required to stabilize domestic and industrial wastes. For the degradation of oxidizable organic matter to take place minimum of 2 to 7 mg/L of DO level is to be maintained at laboratory experimentation or should be available in the natural waters (De, 2003).De A.K., (2003), Environmental Chemistry, 5th Edition, New Age International Publisher, New Delhi.

Sample Preservation

For Physical and Chemical Analysis Samples should be collected in clean polythene / plastic bottles at least of one litre capacity. Samples of drinking water should be collected from different sources as per following guideline .

Samples should be properly labeled and complete data such as date & time of collection, location, purpose of examination, etc. should be provided.

When using the electrometric method, analyze immediately. The preferred method is in-stream analysis in the field.

Although DO tests should be performed as quickly as possible, samples which are to be tested using the modified Winkler procedure may be preserved by either of the following methods:

1. If the samples must wait for a time period of up to two hours before testing and have no iodine demand, they may be stored by adding manganous sulfate solution, alkaline iodide azide solution, sulfuric acid solution and shaking well (making sure that no air bubbles are trapped or formed).

(Protect the samples stored at this point from strong sunlight and titrate as soon as possible.)

2. Those samples which have an iodine demand may be preserved for 4 to 8 hours by adding 0.7 mL concentrated sulfuric acid (H2SO4) and 1.0 mL sodium azide solution (2.0 g NaN3/100 mL distilled water) to the DO bottle. This will stop the biological activity and maintain the dissolved oxygen levels if stored at the same temperature as the sample or if water sealed and kept at a temperature of 10 to 20°C. As soon as possible, complete the procedure using 2.0 mL manganese sulfate solution, 3.0 mL Alkaline iodide azide solution and 2.0 mL concentrated sulfuric acid.

The water samples were collected from each of the five selected stations according to the standard sampling methods [8,9].Samples for estimating dissolved oxygen (DO) and biochemical oxygen demand (BOD) were collected separately in BOD (glass) bottles. Water temperature was recorded on the spot using thermometers[8].

In general, the following assertions may be made:

• a high BOD indicates a high content of easily degradable, organic material in the sample

• a low BOD indicates a low volume of organic materials, substances which are difficult to break down or other measuring problems (see below)

• the shape of the BOD graph (see above) shows what further information may be gained from the measurements (conformance with the measurement range; problems; pattern of decomposition)

III. Results And Discussion

Dissolved oxygen and biochemical oxygen demand of the Kowsar dam reservoir during 12 months were analyzed which the results were illustrated in below tables .

TABLE I
DATA AND STATISTICAL PARAMETERS OF BOD AND DO

Parameter Month	BOD mg/l	DO mg/l
Mar2010	5	8.14
Apr2010	8.9	8.14
May2010	25.9	8.59
Jun2010	23.61	8.17
Jul2010	6.25	7.28
Agu2010	6	6.99
Sep2010	13.6	7.46
Oct2010	6.1	7.12
Nov2010	5.11	7.38
Dec2010	4.21	7.48
Jan2011	2.3	8.78
Feb2011	2.8	8.7
MAX	25.9	8.78
MIN	2.3	6.99
AVR	9.1483333	7.8525
STD	7.8760094	0.6405129
VAR	62.031524	0.4102568
SKEW	1.5395761	0.185715

Numerous scientific studies suggest that 4-5 parts per million (ppm) of DO is the minimum amount that will support a large, diverse fish population. The DO level in good fishing waters generally averages about 9.0 parts per million (ppm).When DO levels drop below about 3.0 parts per million, even the rough fish die. The table in this section shows some representative comparisons. The observation and graphical representations of BOD and DO of collected water samples are given in table I and figs 2 and 3.

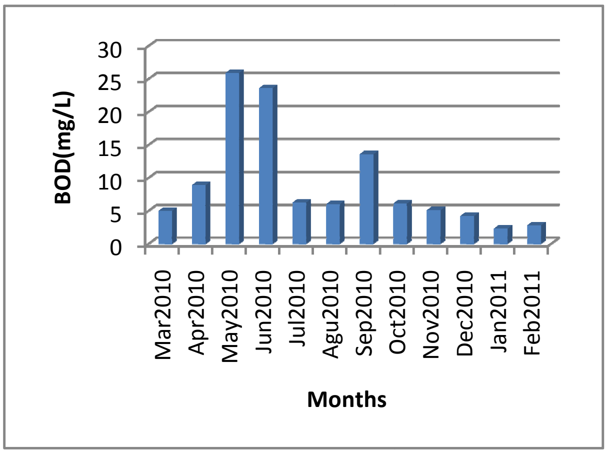

Fig. 2 Monthly values of BOD in the sampling station

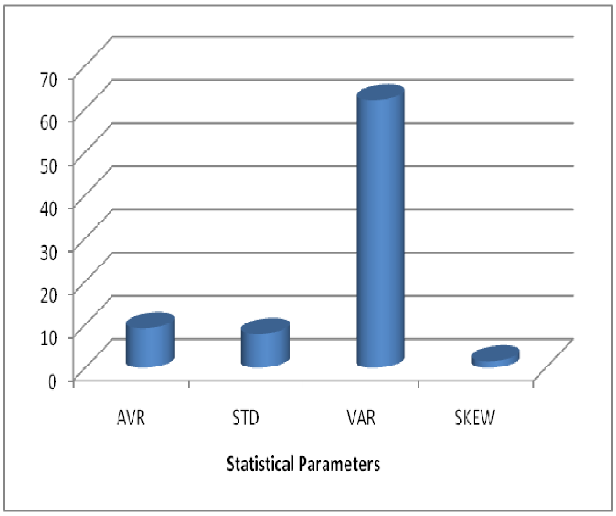

Fig. 3 Statistical parameters of the data (monthly BOD)

From the Table I a significant observation comes out in respect of Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) of the water samples. It was found that the DO values were more than the standard limit and the BOD values were higher than the standard limit.

IV. Conclusion

Water quality of the Kowsar dam reservoir was evaluated through surveying the biochemical oxygen demand and dissolved oxygen during 12 months . Based on field surveying and laboratory analysis the amounts of Dissolve oxygen (DO) and Biochemical Oxygen Demand (BOD) were determined for samples, and the results are illustrated in above table and figures . Then data were evaluated and classified by Excel software. As the results show, the pollution index parameters of BOD and DO have appropriate range. From the Observation of Physico-chemical Parameters and Biological Parameters it is concluded that the water quality of the Kowsar dam reservoir is not suitable for drinking purposes due to high Biological Oxygen Demand content.

Acknowledgment

The authors wish to thank the research committee of Kohkiluye and Boyer Ahmad regional water authority, Islamic Azad University, Fars Science and Research branch for funding this research. Further, we thank all whose names are not mentioned here for their valuable contribution to the success of this research.

References

[1] Norman E. Peters, and Michel Meybeck, Water Quality Degradation Effects on Freshwater Availability: Impacts of Human Activities ,International Water Resources Association Water International, Volume 25, Number 2, Pages 185–193, 2000
[2] Falkenmark, M. L. Andersson, R. Castensson, and K. Sundblad, eds. Water, A Reflection of Land Use – Options for Counteracting Land and Water Mismanagement. NFR, Swedish Natural Science Research Council, Stockholm, Sweden: 128 pages .1999
[3] Food and Agriculture Organization of the United Nations (FAO). Aquaculture -- new opportunities and a cause for hope. http://www.fao.org/focus/e/fisheries/aqua.htm viewed on November 10, 1999.
[4] Grant, A., & A.D. Briggs. 1998. Use of Ivermectin in marine fish farms: Some concerns. Marine Pollution Bulletin. 36(8): 566-568.
[5] Costelloe, M., Costelloe, J., O'Connor, B. and P. Smith. 1998. Densities of polychaetes in sediments under a salmon farm using Ivermectin. Bulletin of the European Association of Fish Pathology. 18(1): 22-25.
[6] Hem, J.D. 1985. "Study and Interpretation of the Chemical Characteristics of Natural Water." U.S. Geological Survey Water-Supply Paper 2254: 263 pages,1985.
[7] Meybeck, M. 1996. "River Water Quality: Global Ranges, Time and Space Variabilities, Proposal for Some edefinitions."Internationale Vereinigung für Theoretische und Angewandte Limnologie, Verhandlungen 26: 81–96.
[8] Standard Methods for Examination of Water and Waste Water. APHA Inc., New York, 20th Edition, 2-9, 2-48, 4-87, 4-134, 5-3, 9-47.
[9] IS:2488, (1966), Indian standard code on methods of sampling and tests for industrial effluents, IS:2488,(1966) – Part 1, Bureau of Indian Standards, New Delhi.