AYDUGHMUSH RIVER WATER QUALITY SURVEY

ETUDE DE LA QUALITE D'EAU DE LA RIVIERE AYDUGHMUSH

Reza Shokuhi[1], Edris Hoseinzadeh, Mehdi Alipoor, Qasem Soltanzadeh and Sayed Javad Jafari

ABSTRACT

Aydughmush River is about 132 km from upriver Qurt Yemz and Qara Kand to down river Qaranqu River. Ladybug River is about 132 km from upriver Qurt Yemz and Qara Kand to down river Qaranqu River. It plays a key role in supplying water for production, life and irrigation for agricultural use. With the agriculture development, the pollution of the Aydughmush River has become a serious matter, recently. The aim of this study was to survey Aydughmush River Water Quality.

As a cross sectional study the BOD, COD, DO, Nutrients (PO_4, NO_2^{-2}-N, NO_3—-N, , NH^{4+}-N), EC, Total Hardness (TH), Total Alkalinity (Talk), pH, Total Coliforms (TC) and total Fecal Coliforms (FC), water temperature and heavy metals were measured using standard methods in eight sampling stations along the river three times in one year. Results were analyzed using SPSS software and descriptive statistics. Results show that pH has been at 8.1-8.5 range, maximum and SO_4 in all stations was within drinking standard level. Mean water temperature was between 8.5-13° C range and maximum EC and minimum DO occurred at two stations. Phosphorus and Nitrate nitrogen varied from 0.22-0.94mg/l and 0.04-1.2mg/l, respectively, and concentration of Be and Fe were more than other heavy metals. The results of water quality Aydughmush review showed some pollution along the river though no water quality was substantially affected. Livestock waste is one of the factors affecting the river pollution.

Key words: *Water quality, Aydughmush, Phisico-chemical parameters, River.*

RESUME

La rivière Aydughmush, long de 132 km s'étend de rivière Qurt Yemz et Qara Kand en amont, jusqu'à la rivière Qaranqu en aval. La rivière Ladybug de 132 km prend son source vers l'amont de Qurt Yemz et Qara Kand, jusqu'à la rivière Qaranqu rivière. Elle est importante pour

1 Department of Environmental Health Engineering, School of Public Health, Centre for Health Research, Hamadan University of Medical Sciences, P.O. Box 4171, Hamadan, Iran, E-mail : edris-2020@hotmail.com

alimenter l'eau pour la production, les besoins quotidiens et l'irrigation agricole. Récemment, la pollution de la rivière Aydughmush est devenue importante suite au développement agricole. L'objectif de cette étude est un examen de la qualité d'eau de cette rivière.

Pour mener une étude détaillée, l'eau de la rivière a été testée pour vérifier la présence de DBO, DCO, OD[2], substance nutritive (PO_4, NO_2^{-2}-N, NO_3—-N, NH^{4+}-N), la conductivité électrique, la dureté totale, l'alcalinité totale, pH, les coliformes totaux, les coliformes totaux fécaux, la température de l'eau et les métaux lourds. Ces testes ont eu lieu trois fois sur un an selon les méthodes de référence dans huit postes d'échantillonnage. Les résultats ont été étudiés selon le logiciel SPSS[3] et selon les statistiques descriptives. Les résultats montrent que le pH est entre 8.1 – 8.5 maximum et SO4 était dans les limites de l'eau potable standard. La température moyenne était entre 8.5 - 13° C et la conductivité électrique maximum et l'oxygène dissous minimum a eu lieu à deux postes d'échantillonnage. Le phosphore et le nitrate d'azote a varié de 0.22 mg/l – 0.94 mg/l et 0.04 mg/l – 1.2 mg/l respectivement, et la concentration de Be et celle de Fe était plus que celle des autres métaux lourds. Les résultats de l'étude de la qualité d'eau de la rivière Aydughmush montrent la présence de la pollution au long de cette rivière bien que la qualité d'eau n'a pas été atteinte. Les déchets du bétail sont l'une des causes de la pollution de la rivière.

Mots clés : *Qualité d'eau, Aydughmush, paramètres phisio-chimiques, rivière.*

1. INTRODUCTION

Freshwater ecosystems play an important role in preparing and providing food, agriculture, clean water supply and recreational and aesthetic aspects (Postal and Carpenter, 1997; Covich, et al, 2004). Agricultural and industrial development result in generation of polluting agents, which contaminate the water and the soil resources causing health risk (Development of industry and agriculture resource development, resulting in artificial pollutants, engineering and construction processes within rivers and surface water pollution risk to ever become a serious threat (Giller, 2005). In the past, the quality of surface water resources was assessed through the evaluation of certain chemical parameters. The biological tests, however, are more accurate for understanding water quality (Brian, et al, 2003), and fecal coliform data has been used as one of the best indicators for the presence of microorganisms. Fecal and total coliform tests done simultaneously with other physico-chemical parameters, can detect changes in water quality due to wastewater discharged from industrial or domestic sources, etc., and these have also been used. For optimum assessment of water quality, a combination of physical, chemical and biological parameters should be chosen (Lavado, et al, 2006). Human societies are established near the rivers. So the river water quality invariably gets affected anthropogenic factors (Yang, et al, 2007). The purpose of this study was evaluation of the quality of Aydughmush river water. In this study, microbial and physico-chemical indicators were used for river water quality assessment.

2 Oxygène dissous.

3 SPSS (Staistical pacakage for the Social Sciences) est un logiciel utilisé pour l'analyse statistique. En 2009, la compagnie change le nom de ces produits en PASW, pour Predictive Analytics Software.

2. CASE STUDY: AYDUGHMUSH RIVER

Aydughmush River's catchment is spread over 47^0 44' 4" to 47^0 44' 5" E longitude and 36^0 43' 14" to 37^0 23' 22" N latitude. It is bounded by Qaranqu catchment in the north, Aji Chay catchment in the south, Ajjer Loo chay watershed in the east Quri Chay watershed in the west.

Aydughmush Basin area is 1836.6 km^2 in area. Aydughmush is the main tributary of the Ghezel Ozan River, which is formed by joining of two smaller rivers upstream of the Babune Bala village in the Hashtrood city, and at route, it is enriched by lateral flows from other tributaries, the major being the Zolm Abad and Q**ū**rt Yemaz (East Azarbaijan Regional Water Authority, 1384[4]).

3. METHODS

To provide the final analysis result of the condition Aydughmush River, water sampling and sample analysis was done three times at the selected sampling stations(Figure 1). Position of sampling stations is given in Table 1.

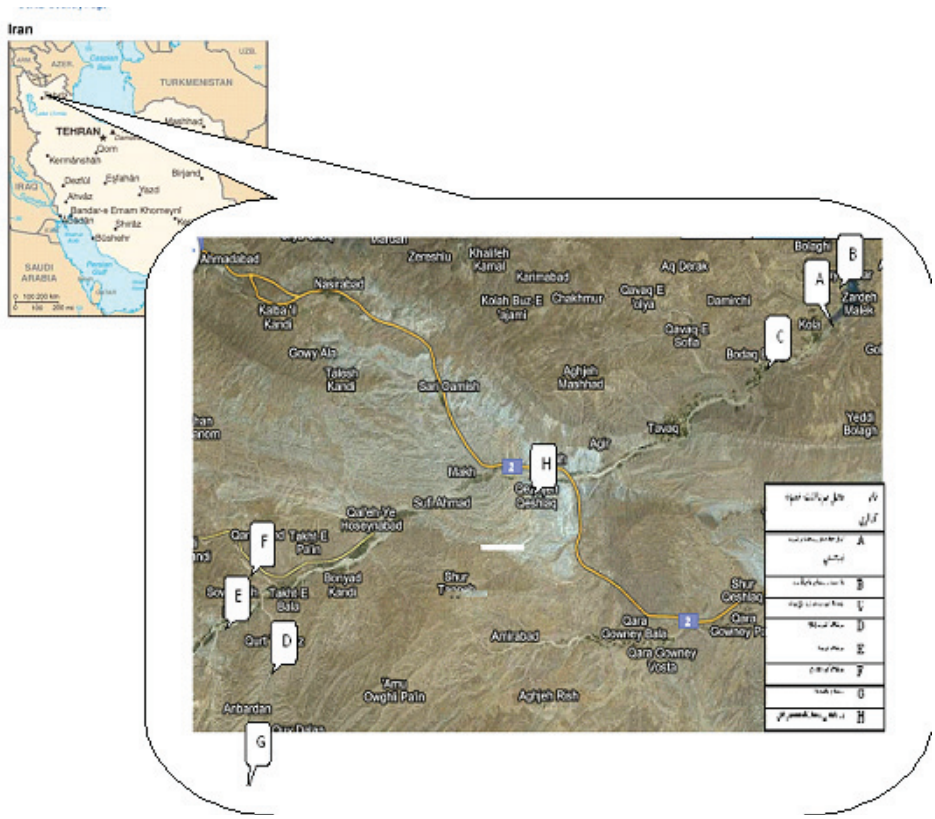

Fig 1: Satellite map of Aydughmush River and sampling locations along designated rivers

4 All years starting with 13 are according to Iran calendar. To get the corresponding English calendar year, add 621.

Table 1: sampling stations description

Sample Location	name
Before connecting the river Qaranqu to Aydughmush	A
Upstream village Ch**ā**y Talv**ā**r	B
Bod**ā**q Beyg gauging station	C
Branches Q**ū**rt Yemaz	D
Branches Korj**ā**	E
Branches Qareh Kand**ī**	F
Babune Bala village	G
bridge of ghale Hussain Khan Village	H

Parameters to evaluate the quality of the Aydughmush river water were: phosphate, nitrite, nitrate, ammonia, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride, sulfate, sodium, total dissolved solids, total alkalinity, total hardness, electrical conductivity, pH, temperature, fecal coliform, total Coliforms and heavy metals.

At each sampling station, samples were taken from the top 30 cm of the flowing water body and at 3 positions (center and the two edges). All tests were done according to standard methods (APH Association, 1998). The results were described through Tables and graphs.

4. RESULTS AND DISCUSSION

pH: pH values, as observed in Figure 1, were alkaline, in the range of 8.1 to 8.5. Natural waters pH depends on the balance between carbonate - bicarbonate and carbon dioxide (Yang, et al, 2007). Alkaline pH is preferred in surface waters, as heavy metals combination with carbonate / bicarbonate are removed from water environments (Ahipathy and Puttaiah, 2006). Alkaline pH of water may be due to its clean and low amounts of suspended solids and BOD. In contaminated water, decomposition of organic material can lead to acidification of water, which should be neutralized (Chetana and Somasekhar, 1997). The results of this phase are consistent with study results of Yang et al (2007).

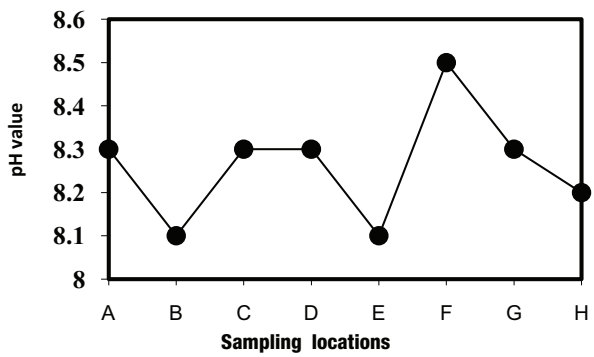

Fig 1 : Changes in pH sampling stations

Total Dissolved solids (TDS): TDS represents the total non-volatile substances dissolved in water. Effect of soluble salts on plant growth depends on the osmotic process. Water with high mineral may be lead to livestock death. TDS levels of the samples ranged from 314 to 1264.7 mg/l. the lowest and highest values were at stations D and B, respectively. This part of the results is consistent with the results of Hooshang, et al (1386). Water with TDS less than 200 mg/l is suitable for drinking and a good value for fishing is 2000 mg/l.

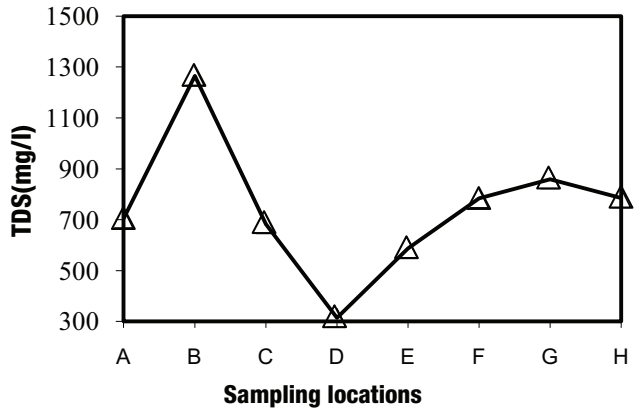

Fig 2 : Changes related to dissolved solids in the sampling stations

Dissolved Oxygen: dissolved oxygen is an important parameter in estimating the ecological health of water environments. Changes in DO at different sampling locations is shown in Figure 3. The low DOs are due to high water temperatures and increased activity of microorganisms in the water which consume a lot of oxygen, and decomposition of organic material. DO levels in water samples depends on physical properties of the river body, water chemical properties and biological activity of microorganisms (Yang et al, 2007).

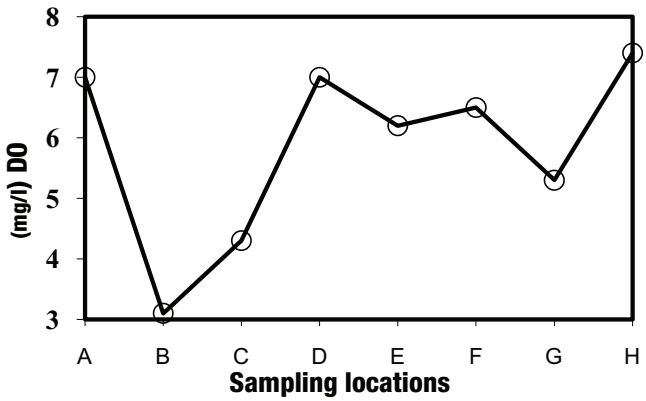

Fig 3 : Changes in the amount of dissolved oxygen sampling stations

Biochemical Oxygen Demand: BOD is one of the major factors used in assessing water quality and is related to the dissolved and suspended organic material. Graph corresponding to changes in the BOD in the sampling stations are shown in Figure 4.

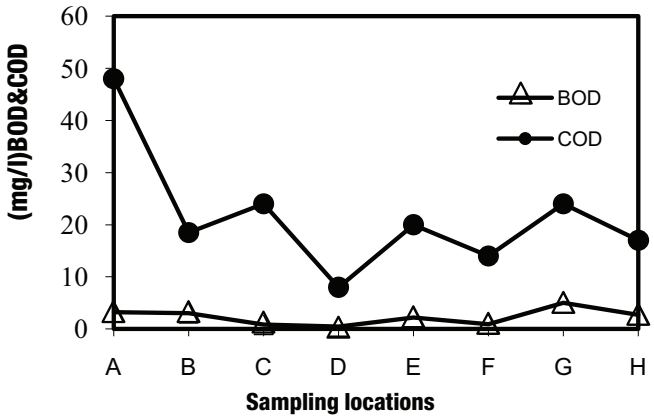

Fig 4 : Changes related to BOD and COD during the sampling stations

Chemical Oxygen Demand: Minimum and maximum COD was seen at stations D and G, respectively. BOD and COD graphs fit together, and changes indicate that this source of organic matter in waste water Aydughmush water flowing from rural and agricultural land and did not add industrial organic materials to the water body. Sewage disposal in most villages are via soak pit, but in the villages located along the river bank, there is no proper sewage disposal method. Accordingly, untreated sewage enters the river there.

Nutrients: Currently, one of the most important problems related to surface water ecology is the eutrophication phenomenon. Nitrate nitrogen, ammonia and phosphate are important nutrients that cause the eutrophication in water zones. There are a lot of nutrients, causing algae growth in large quantities and presence of micro- cysteinein water (Yang et al, 2007). As shown in Figure 5 nitrate, nitrite, ammonium and phosphate concentration in the Aydughmush river water were lowest, respectively, at stations A, D, D, G and G. With self-purification processes of rivers, their concentration decreases. Nitrification process requires a certain amount of dissolved oxygen. In dry seasons, nitrate present in fertilizer accumulates in the soil and is washed away with the next rain.

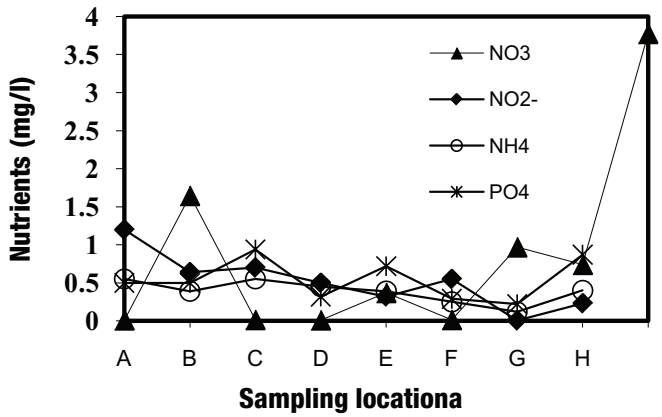

Fig 5 : Changes in nutrient sampling stations along river

Heavy metals: Result of measurement of heavy metals is given in Table 2. Barium levels in natural water bodies is less than 0.1 mg/l, but in some ground water sources, it may go up to 10 mg/l. highest barium concentrations was found at Station E. Presence of Fe can be due to the dissolution of rocks and minerals from acid mine drainage, seepage from landfills and sewage (Sari, 1381).

Table 2 : Mean results of analysis of heavy metals Aydughmush River (ppb)

H	F	E	D	C	B	A	Sampling locatin/ heavy metals
60	57	68	78	57	164	58	Fe
4	*	3	*	*	11	4	Mn
*	*	*	*	*	*	*	Ni
25	30	24	25	30	33	33	Zn
*	*	*	*	*	*	*	Ag
7	5	8	5	9	6	7	Cd
*	*	*	*	*	*	*	Cr
*	*	*	*	*	*	*	Pb
19	*	*	11	27	*	13	Cu
*	*	*	*	*	*	*	Hg
*	*	*	*	*	*	*	Ur
*	*	*	*	*	*	*	Va
*	*	*	*	*	*	*	Se
66	51	128	78	76	74	75	Ba

*:Very small amount

Salinity: High chloride concentration in river water is due to anthropogenic factors and in groundwater due to the chemical composition of the dissolved rocks. Changes in chloride ions in the sampling stations are shown in Figure 6.

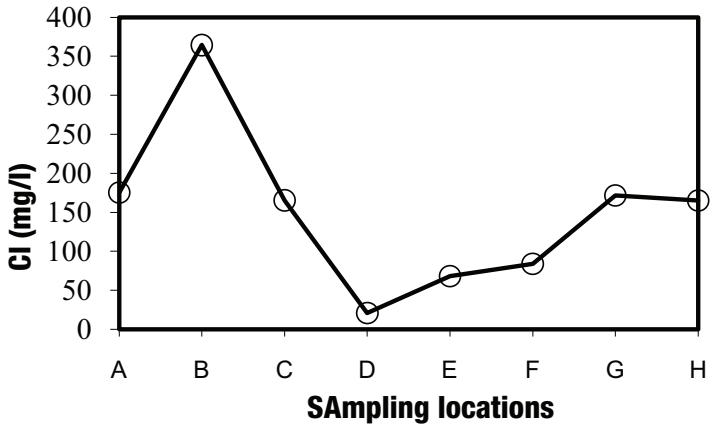

Fig 6 : Change in chloride ion sampling stations

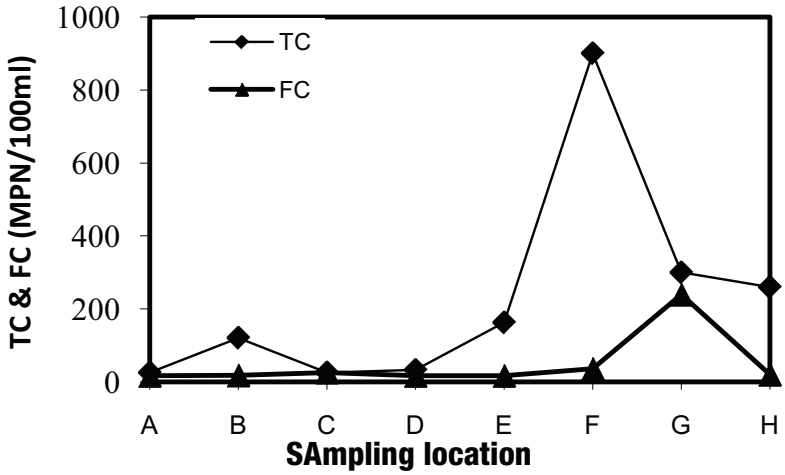

Fig 7 : Total Coliforms and changes in fecal coliform sampling stations

Total and fecal coliform:

The existence of microorganisms and their activities in the area is due the presence of organic matter in the river water. Highest total and fecal coliform were found at stations G and F. Organic matter removal rate is directly related with the number of bacteria (Liang and Wu, 2003). Three stations C, A and D showed coliform count was less t han 100 MPN in 100ml and in others, it was higher. Presence of bacteria in the water may be due to point and non point contaminants.

Alkalinity and total hardness: Alkalinity and hardness of water samples from the sampling stations are shown in Figure 8. Water hardness ranged from 162 to 375. The minimum and maximum values occurred, respectively, at stations D and G.

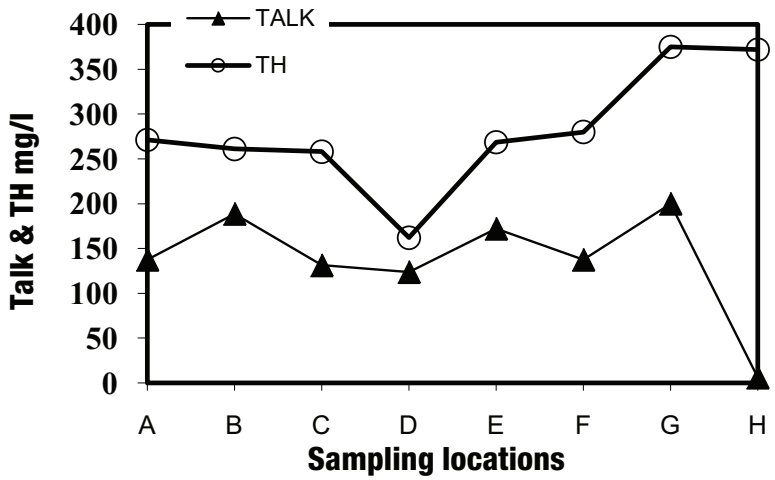

Fig 8 : Change of total alkalinity and total hardness in the sampling stations

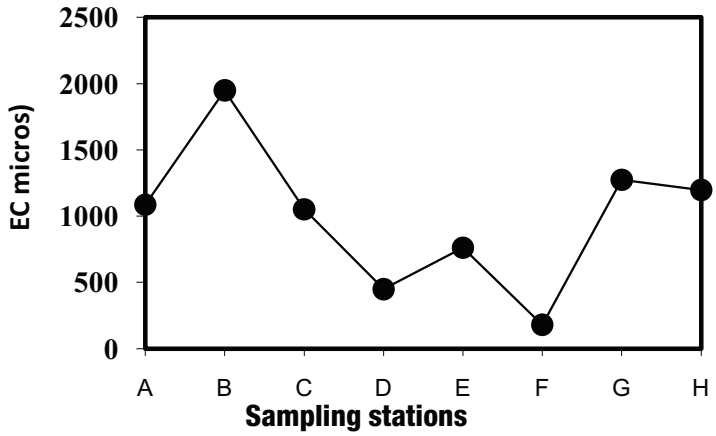

Fig 9 : Changes in electrical conductance sampling stations

Electrical Conductivity: Electrical conductivity indicates a presence of mineral in the water. The highest and lowest value was observed in stations B and F, respectively, (180-1949 micro-mhos).

Wilcox Index: Two factors, electrical conductivity and sodium adsorption ratio are the important parameters in measuring water quality in the context of agriculture. Based on this, Wilcox index was developed (Alizadeh , 1363 and Champman and Kimstach, 1996). As seen in Table 3, the water quality at station B is unsuitable for agriculture.

Tab 3 : Category -class river water based on Weil Cox index

Sampling stations	End Classification	Will Cox ranked based on sodium adsorption ratio	Will Cox ranked based on electrical conductivity	Detailed Class Will Cox
A	C3S2	S2	C3	Passion - for agriculture by applying appropriate measures necessary
B	C3S4	S4	C3	Very salty - harmful for agriculture
C	C3S2	S2	C3	Passion - for agriculture by applying appropriate measures necessary
D	C2S1	S1	C2	A little salty - almost good for agriculture
E	C3S1	S1	C3	Passion - for agriculture by applying appropriate measures necessary
F	C1S2	S2	C1	A little salty - almost good for agriculture
G	C3S2	S2	C3	Passion - for agriculture by applying appropriate measures necessary
H	C3S2	S2	C3	Passion - for agriculture by applying appropriate measures necessary

5. CONCLUSIONS

The results of water quality Aydughmush evaluation showed presence of contaminants along the river, though no water quality was substantially affected. However, in addition to artificial sources, river water quality through erosion and deposition can also be negatively affected. Anthropogenic factors are mainly responsible in causing river water pollution. Livestock waste on pasture land, meadows and play grounds can flow into the river with runoff water and deteriorate the river water quality.

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