

Evaluating the Heavy Metals and other pollutions in Major Rivers in Iran

Siamak Boudaghpour

Abstract—One of the dominant problems of the rivers in Iran is that they become polluted with urban, arable and industrial sewages that it can cause irrecoverable damages for aquatic river ecosystem and environment. Karaj, Aras and Behmanshir rivers are one of the most important and biggest rivers of Iran that everyday are in danger of pollutions. Karaj River is one of the most important rivers of the central watershed that is placed at the north of this territory. Residential areas villages and small towns have been place near Karaj River. Several types of sewages pour in this river and whereas the structure of these sewages is consisted of organic materials therefore in the evaluation of monthly changing of Karaj river pollution we have accessed COD as a major signs of pollutions. Aras and Behmanshir rivers are marginal rivers that farmland and small industrial factories have been placed around them. One of the main problems of the pollution of these rivers is the presence of heavy metals such as nickel, iron, zinc and copper. According to present study the maximum amount of pollution in Karaj River happens in January of every year and also temperature and season alternations have no vital effect on the pollution changing in this river. By evaluating the outcomes of pollution in Aras and Behmanshir rivers it has been figured out that season and temperature alternations have no vital effect on heavy metals and the most important reasons that can cause pollution in this river is the abusing of parasite killers in farms and the sewages of small industrial places that have been placed near these rivers.

Index Terms—Pollutions, Heavy metals, Assessments, Major Rivers

I. INTRODUCTION

Environment is one of the constant pillar of extension in any country. Inattention to the problems of environment can hurt natural and manmade resources and can make some bad results for the globe. The thing that seems more significant to human is the problem of water pollution that it fades much more later than other kinds of pollutions. Nowadays one of the important sources of water pollutions are industries. Home sewages that are polluted with feces that include some kinds of bacteria, viruses and insect killers are the most vital reasons of the pollution of water resources. Pouring industrial agriculture and commercial sewages into the water and other human activities in some degrees that make water unsuitable for drinking or other consumptions can cause chemical pollution. Water chemical pollution is probably the most dangerous and vital kind of pollution. In last decades the accession of dopants with human activities such as heavy metals into the ecosystem has increased a lot that we can consider it as a big danger for the life of earth ecosystem.

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COD is one of the most important indicators for evaluating the pollution of sewages. In fact COD is that amount of oxygen that is needed for oxidation of the whole organic materials of the water. It is obvious that if we have more COD in a sewage we'll have more pollution in that one.

II. EVALUATED GEOGRAPHICAL AREAS

A. Karaj River Territory

Karaj river is one of the important rivers of the central water shed that is placed at the north east of this territory. It emanates from the south side of Alborz mountain and 40 kilometers far from the west of Tehran from Kharsang mountain's central water shed. Karaj river's length is about 245 kilometers and the area of the water shed of this river is about 5000 . Karaj river is one of the most important sources of water of Tehran city and controlling the quality of this water is very important.

B. Aras River Territory

Aras river's watershed located in Iran, Turkey, Armenia and Republic of Azarbayejan countries. This river is one of the most important rivers in Iran that emanates from Araz mountains in Turkey and it passes from Nakhjavan Armenia border and after passing from Iran border it continue to Republic of Azarbayejan and finally it pours in Caspian sea. By increasing the extension of human activities and by the evacuation the sewages from industrial, urban and agriculture hog washes in this river. Some worries have been emerged about environmental situation of this river. Heavy metals are one of the most water dopants that because of toxic impression and making biological accumulation. It can be consider as one of the most dangerous water dopants. Whereas this river is one of the most varied scarce habitat in the country any pollutions in it can have critical impressions on the biological variety ecosystem. On the other hand water of this river is used for agricultural and warm water fishery farms in Ardabil state. There for knowing the amount and kind of dopants meantime presenting some suitable solutions to minimize its effects with suitable planning for using the water for aquatic aims is also necessary.

C. Behmanshir River Territory

Behmanshir is one of the most important rivers in the country in economy point of view. Its water resource for observation the fertility and its roll in producing fish is very Important. This river is one of the most heavy water volume branches of Karoon and about 10 kilometers far from Sable it departs from Karoon and from Behmanshir's bay it pours in Persian gulf. Tide of Persian gulf has some effect on Behmanshir's water resources that It can recognized as Behmanshir flow is very low the effect of the tide of the

water can be observed from Behmanshir to Ahvaz city, but in natural condition the effect of the tide can achieve to Darkhoin. Behmanshir's length is about 73 kilometers that starts from the joint of Karoon to Hafar and Behmanshir and it extends to Persian gulf.

III. DATAS AND STATISTICAL ANALYSIS

The observation location of karaj river is the output water gauging dam station that it's statistics and information have been sampled and examined by sewage and water company of Tehran state laboratory . The statistics that is used in this observation includes COD density monthly through 12 years from September of 1999 to the April of 2011. The annually average diagram of COD of Karaj river in every month through the statistics period has been shown in figure 1.

Sampling of Aras river in Ardabil state area in the year 2008 about one year duration and monthly from 3 stations have been considered. Figure 2 shows the average amount of examined heavy metals in these three stations in every month.

Sampling for measuring heavy metals from autumn of 2004 to the summer of 2005 in 5 stations and in the second month of every year have been considered. Figure 3 shows the average amount of examined heavy metals in these 5 stations in every month.

IV. RESULTS AND DISCUSSIONS

Residential areas ,villages and small towns are placed near Karaj river that the sewages of them pour in this river and whereas that the structure of these sewages is consisted of organic materials therefore in the evaluation of monthly changing of Karaj river's pollution COD was significant. As it is shown in figure 4 the maximum amount of COD happens in Januaries of every year (3.1 mg/lit) and also Karaj river has the maximum amount of pollution that is caused by organic materials at the same time. Also in July (2.3 mg/lit) and January (2.25 mg/lit) it has the minimum amount of COD and therefore it faces the decrease of pollution . Actually temperature alternation and changes of seasons have no significant effect on COD and pollution procedure in this river.

Marginal Aras river that is placed at the north of the country and some farmlands and small industrial places have been located around it . One of the problems of this river pollution is the presence of heavy metals such as : iron , zinc , nickel , copper and lead in it . According to the discoveries of this research as it has shown in figure 2 in November (.24 mg/lit) the maximum amount of Iron and in March , April , May , July , January and February the minimum amount of Iron in this river (.12 mg.lit). About Zinc metal in Aras river in February (.035 mg/lit) the maximum amount and in August (.009 mg/lit) the minimum amount in it . According to the diagram it can be figured out that temperature and season alternations can have no significant roll in the Zinc pollution changes in this river. About Copper metal it was observed the maximum amounts in four month: September(.018 mg/lit) ,October (.035 mg/lit) , November (.023 mg/lit) < December (.012 mg/lit). Industrial sewages elements can be the reason of increase of Copper in these four month there for agriculture activities and season and temperature alternations has no role in changing of Copper

density in Aras river. About Nickel metal that often observed in industrial sewages the maximum amount can be observed in June (.014 mg/lit) and it can observe some big amounts of Nickel just in May (.003 mg/lit) and February (.008 mg/lit) and in other month it has the minimum amount. About Lead metal in July (.073 mg/lit) and September (.067 mg/lit) it has the maximum amount in this river that can be because of using insect killers and limited industrial activities and in other month it has the minimum amount that it can have forever (.004 mg/lit).

Behmanshir river is at the south west of the country and it has been placed in marginal areas . Farmlands and small industrial places have also been placed around this river. This river has been polluted by heavy metals such as : Zinc, Lead , Cadmium ,Nickel ,Cobalt and Copper . according to the observations that have been done , as you can see in shape 6 the maximum amount of Zinc is in spring(364 mg/kg) and autumn(332 mg/kg) and the minimum amount of it happens in winter(244 mg/ kg) and summer (266 mg/kg).so season alternations have no direct impact on Zinc changes. About Lead metal we face the maximum amount of it in summer (59.8 mg/kg) and winter(59.6 mg/kg) and the minimum amount in fall(56.4 mg/kg) that can be because of using of insect killers. About Cobalt metal in autumn (9.6 mg/kg) we face the growth of amount of it and this growth has a steady procedure all over the year. About Cadmium metal the maximum amount can be seen in autumn (2.2 mg/kg) and summer(2.1 mg/kg).about Copper metal it has the maximum amount in summer (46.8 mg/kg) and industrial sewages can be it's reason. About Nickel metal that it often can be found in industrial sewages the maximum amount can be observed in winter(61 mg/kg).

V. CONCLUSIONS

Based on present research following results have been achieved:

In Karaj river in December the maximum amount of pollution of urban sewages has been observed as compare to July and January this pollution would achieve to the minimum degree. The variation of temperature and seasons have no significant impact on the pollution alternation in this river.

In Aras river in February the maximum degree of Zinc and in August the minimum degree Zinc have been observed . In November the maximum amount of Iron in Aras river and in March , April ,May , July, January and February the minimum amount of Iron have observed . In September , October , November and December the maximum amount of Copper in this river have been observed comparatively. The maximum amount of Nickel has been observed in June. Lead metal in July and September has the maximum amount. By considering data and diagrams obviously the temperature and seasons alternations cannot have any significant role in changing of pollution in this river. Some elements such as small industrial sewages , agriculture activities and using of insect killers can have some effects on the changing of pollutions in this river.

In Behmanshir river the amount of Cobalt metal has a steady procedure all over the year but in autumn it shows growth . The maximum amount of Cadmium has been observed in autumn and winter . The maximum amount of Zinc observed in spring and autumn and the minimum

amount observed in summer and winter. Lead metal has the maximum amount in summer and Nickel metal has the minimum amount in winter. About copper metal it has the maximum amount in summer and Nickel metal has the maximum amount in winter. In this river also by observing the data and diagrams it figured out the variation of temperature and seasons have no considerable effect on the changing the amount of pollutions . In Aras river also some elements such as small industries sewages , agriculture activities and using insect killers have some effects on the pollution alternation.

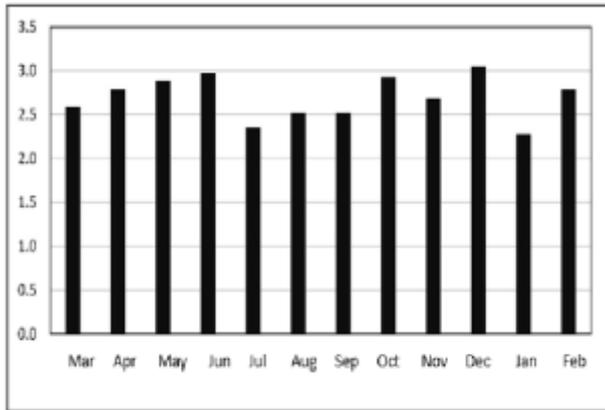


Figure 1 : Annually average of COD in every month diagram

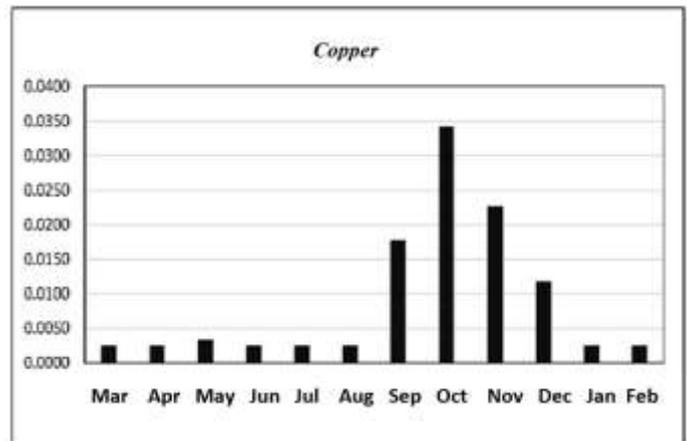
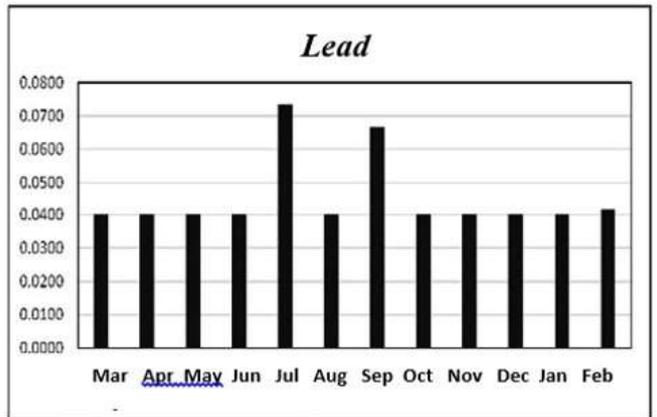
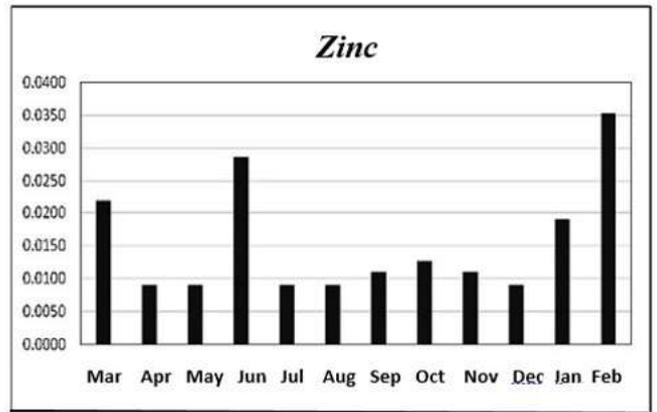
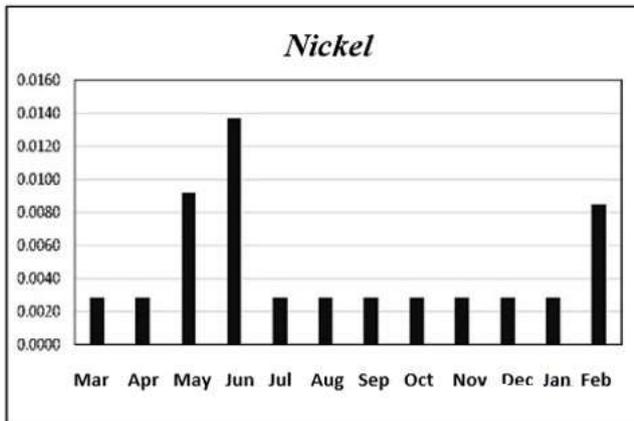
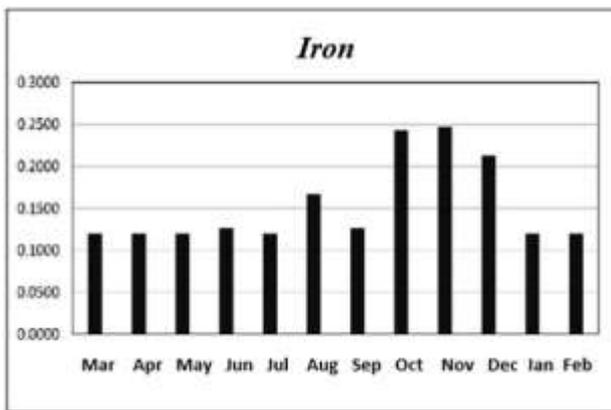
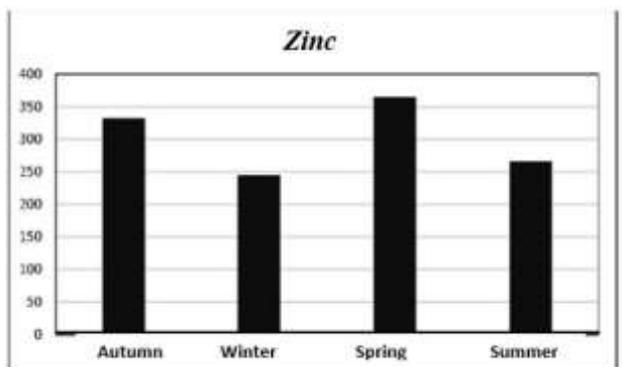


Fig. 2: The regional monthly average amount of heavy metals



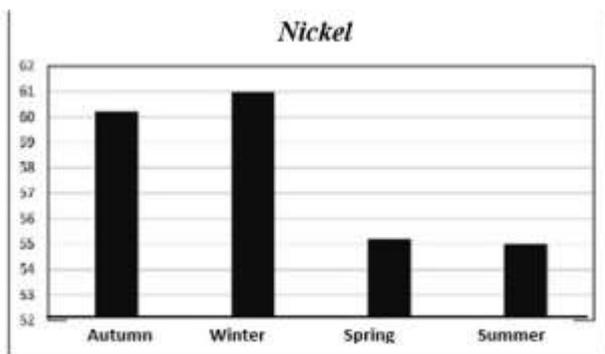
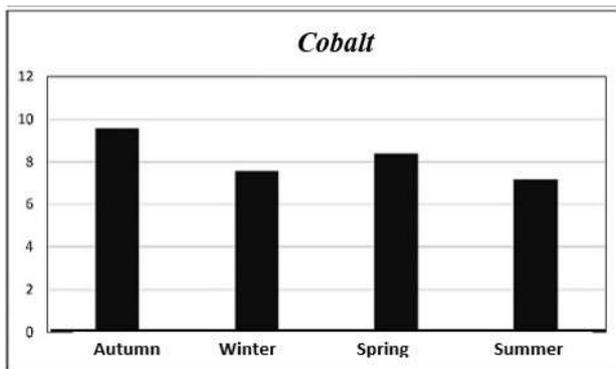
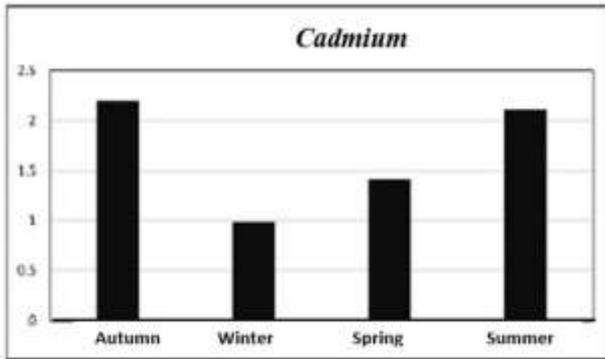
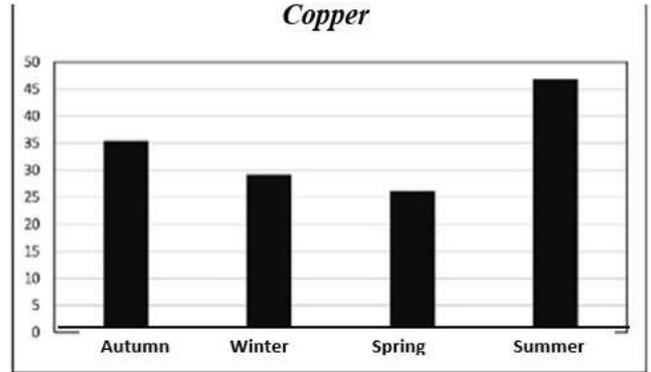
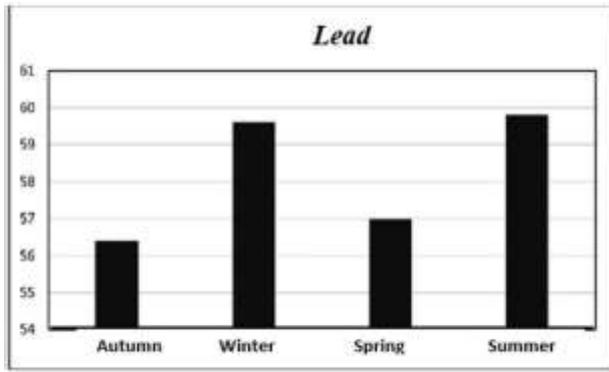


Fig. 3: The regional monthly average amount of heavy metals

REFERENCES

- [1] Rogers GR. Water quality management at Santa Cruz Harbor. Aire-O2 News 2000;7:4-5.
- [2] [2] Spencer KL, Dewhurst KE, Penn P. Potential impacts of water injection dredging on water quality and Eco toxicity in Limehouse Basin, River Thamea, SE England, U K. Chemosphere 2006;63:509-21.
- [3] Chaerum SK, Tazaki K. Bioremediation of Coastal areas 5 years after the Nakhodka oil spill in the Sea of Japan: isolation and characterization of hydrocarbon-degrading bacteria. Environ Int 2004;30:911-22.
- [4] Sato K, Sakui H, Sakai Y, Tanaka S. Long-term experimental study of the aquatic plant system for polluted river water. Water Sci Technol 2008;46:217-24.
- [5] Clark, R.B. Marine pollution. Third Edition. Clarendon press oxford, 1992. 172p.
- [6] Sadiqe, M. Toxic metal chemistry in marine environments. Marcel Dekker, 1992. Inc. 389p.
- [7] Mance, G. Pollution threat of heavy metal in aquatic environment. Elsevier science Publishers LTD, 1990. p. 372



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- (1) For M.Phil research, I developed a new mathematical relationship between runoff parameters(maximum mean daily discharge and lag time) and catchment characteristics such as rainfall, area, length of main river and average slope of catchments. Fifteen catchments in northern Pakistan with nearly same climatological conditions have been considered. The accuracy of mathematical models have been cross checked with actual field data.
- (2) During the M.Phil research, I attended a two week courses in applications of Computer in hydraulic engineering. The course covered several computer programming techniques and calculations in hydraulics.
- (3) For Ph.D research, I did the lumping process based on unsaturated infiltration theory (rain into the soil), where the Richards equation was adopted as a fundamental equation for the solution of unsaturated infiltration flow. At the first stage, a new boundary condition (at the outlet of the soil column) has been introduced and its accuracy has been cross checked with experimental results. At the second stage, non-dimensional and lumping processes have been proposed. Finally, a new fully lumped equation (storage function model) has been achieved to explain the relation between storage of unsaturated water in the soil with discharge at the outlet of catchment which showed satisfactory results in cases of long duration rainfall.
- (4) From 1st, April to 31st July 1995, I attended a research at Hokkaido Civil Engineering Research Centre based on the effect of vegetation on river sediments and suspended materials. Mathematical models have been proposed to explain the actual Phenomena in the experimental river.
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LIST OF PUBLICATIONS:

- 1- Boudaghpour.S (1989)
 Development of relation between runoff parameters & catchment characteristics M.Phil thesis, Centre of Excellence in Water Engg Publication, Lahore, Pakistan.
- 2- Boudaghpour, S(1990)
 Mathematical relationships between runoff and catchment characteristics in northern Pakistan, annual conferences in Civil Engg, JSCE, Vol 21, 331-333.
- 3- Fujita,M, Kyoshi,H, Boudaghpour,S, Takahashi,K, And Hagiwara,K. (1991)
 Experimental Study on the Unsaturated Flow in Soil Column with Vertical Void, proceeding of Japan Society of Civil Engineering Hokkaido Branch, Vol. 47, 371-376.
- 4- Fujita,M, Boudaghpour,S, Takahashi,K, and Hagiwara,K.(1991)
 Numerical Analysis of Unsaturated Flow, proceeding of Japan Society of Civil Engineering Hokkaido Branch, Vol. 47, 371-376.
- 5- Fujita,M, Yamamoto,T, Takemoto,N, and Boudaghpour,S. (1992)
 Experimental Study on the Unsaturated Infiltration Processes with Surface Flow,

- proceeding of Japan Society of Civil Engineering Hokkaido Branch, Vol.48, 581-586.
- 6- Yamamoto,T, Boudaghpour,S, Fujita,M, Shimizu,Y, and Kado,M (1993)
 Numerical Analysis of Infiltration Flow with Surface Flow, proceeding of Annual Japan Society of Hydrology and Water Resources.
 - 7- Fujita,M, Yamamoto,T, and Boudaghpour,S (1994)
 Construction of Golf Course on Runoff Characteristics, proceeding of Japan Society of Civil Engineering Hokkaido Branch, Vol.50, 428-431.
 - 8- Boudaghpour,S, Fujita,M, and Shimizu,Y. (1995)
 Lumping Process Based on Unsaturated Infiltration Theory, proceeding of Japan Society of Civil Engineering Hokkaido Branch, Vol.50, 308-313.
 - 9- Boudaghpour,S, Mirbagheri,A, Vali,A. (2004)
 Determination of Mathematical Model for Distribution of Dissolved Oxygen in Activated Sludge System, journal .Env.Sci, Tech, Autumn, 2004, No22
 - 10- Boudaghpour,S, Mirbagheri , a, Mirzai fashami,o (2006)
 A Study of Sludge Production In Waste Water Treatment Plan By Activated Sludge Method with Optimizing The parameters of Treatment, Env.Sci, Tech, Summer, 2006, No29
 - 11- Boudaghpour,S, Marghoob,B (2007)
 Irregular Withdrawal of Alluvium from the River-Based and Disadvantage on Environmental Demolition, 7th International Conference for River Engineering Ahvaz, Iran.
 - 12- Siamak Boudaghpour, and Shervin Hashemi (2008)
 A Study on Light Expanded Clay Aggregate (LECA) in a Geotechnical View and its Application on Greenhouse and Greenroof Cultivation Issue 4, Volume 2, INTERNATIONAL JOURNAL OF GEOLOGY
 - 13- S. Boudaghpour, S.A Hashemi Monfared, S.A. Haghshenas (2009)
 Prediction of air pollution due to traffic by means of artificial neural network
 WORLD APPLIED SCIENCES JOURNAL, Volume 7: 156-161
 - 14- Siamak Boudaghpour1* and Alireza Jadidi2 (2009)
 Investigation of the effect of outlet pollutants of cement production industries around Tehran and approaches to control and eliminate pollutants. International Journal of Physical Sciences Vol. 4 (9), pp. 486-495, September Available online at <http://www.academicjournals.org/IJPSISSN> 1992 - 1950 © Academic Journals
 - 15- Leila Ahmadi(1), S Boudaghpour(2), A Ahmadi (2009) Role of landfills in increasing greenhouse gases emission: case study:Tehran landfills methan emission rate,measure by landgem model.
 Earth and Environmental Science 6 . 282007
 doi:10.1088/1755-1307/6/8/282007
 - 16- Siamak Boudaghpour (2011) Effects of leaking out oil in areas around Iran’s Refineries International Journal of the Physical Sciences Vol. 6(15), pp. 3671–3678, 4 August, Available online at <http://www.academicjournals.org/IJPS> ISSN 1992-1950 ©2011 Academic Journals
 - 17- Siamak Boudaghpour · Majid Bagheri · Zahra Bagheri (2014)
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 - 18- Siamak Boudaghpour , Farid Majdzadeh (2014) Environmental Effects of Lime on Mechanical Characteristics of Stabilized closed Texture International Journal of Geology, volume8
 - 19- Ghasemzadeh, H.; Ramezanpour, M. A.; Bodaghpour, S. (2014)
 Dynamic high order numerical manifold method based on weighted residual method
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- 20- Siamak Boudaghpour¹, Majid Bagheri^{1,*} and Zahra Bagheri (2014) Using Stochastic Modeling Techniques to Predict the Changes of Total Suspended Solids and Sediments in Lighvan Chai Catchment Area in Ira Journal of River Engineering Volume 2, Issue 1
- 21- Boudaghpour S, Foroughi M, Kalhor K.(2014) "Evaluating Environmental Impacts of Salt Used for Deicing the Chalus Mountainous Road in Iran", International Symposium on Green & Sustainable Technology, Malaysia, 2014 (Oral)
- 22- Boudaghpour S, Kalhor K(2014). "Stabilization of Closed-Texture Soils by Using Lime and Evaluating its Economic and Environmental Effects", National Congress on Soil Mechanics and Foundation Engineering, Iran, 2014 – (in Persian)
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- 24- Boudaghpour S, Kalhor K. (2015) "Earthquake and its Environmental Effects, Case Study: Tehran City", 3rd International Symposium on Environmental and Water Resources Engineering, Iran, 2015
- 25- Siamak Boudaghpour (2016) The Study Based on Collapsible Soils and Their Collapse Potentials in Semnan Desert Area in Iran International Journal of Scientific & Engineering Research, Volume 7, Issue 12, December- 546 ISSN 2229-5518
- 26- SHERVIN HASHEMI^{1,*}, FARID HASHEMI¹, SIAMAK BOUDAGHPOUR², and SETH (2016) Comparing the Applicability of Soil Water Retention Models International Journal of Environmental Science ISSN: 2367-8941 Volume 1
- 27- Siamak Boudaghpour¹, Shervin Hashemi², Farid Hashemi², and Seth Engel³ (2016) Water Quality Evaluation Modeling for the Hablehrood River under Various Hydrological Conditions Modern Environmental Science and Engineering (ISSN 2333-2581) July, Volume 2, No. 7, pp. 470-475 Doi: 10.15341/mese(2333-2581)/07.02.2016/005
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