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Pollution resources in Sefidroud River Basin in Guilan province - IRAN

Asan Bagherzadeh[1*] and Shoghy Ghochaily[2]

1. Environment PH.D student, Baku State University
2. Professor of ecology and environment ,Baku state university-Azerbaijan Republic

***Corresponding author*:** Asan Bagherzadeh

ABSTRACT: The rivers are one of the main sources of water supply for different usage like agriculture, domestic and industrial. Therefore, according to the recent droughts in the country and also urban and rural development it is important to conserve these resources. In the basin of Sefidroud river ther is a small river that named Siyahroud. The rivers after passing from the eastern part of Rasht City reach to Pirbazar River and at the end to Anzali Lagoon. A lot of wastewater from factories, urban and agricultural activities discharge directly to the river and put the river in danger. In this Case study the pollution resources and the quality parameters of the river analyzed and compared with quality standard of Iran Department of Environment. Furthermore the discharge of the river during 40 years period analyzed and the months with lowest discharge determined. Then the pollution trend during the year compared with the discharge of the river and at the end some suggestion presented to joint of a section Sefidroud river to Syahroud for reduce the impacts of pollution.

***Keywords*:** Water resource, Pollution sources, Siyahroud River.

INTRODUCTION

The rivers are one of the main sources of water supply for drinking, agriculture and industrial activities. Most civilization forms besides the rivers because the nations need water for living and development. Development and population growths cause the water deficit so the water storage design and constructed to controlled and to optimum use of these resources. The long and safe rivers are one of the important factors in civilization development then the water pollution is so important among the environmental damages. Decrease in water quality in the world causes a lot of countries changes the viewpoints on water resources management and the water management systems expose to a basic change. Furthermore the human activities are the most effective factor on environmental changes. All human activities effects the environment but stop all of that are impossible because some of those are needful for existence. But we must careful and controlled the activities to minimum damages (1). One of the most pollution factors are the industrial, urban and agricultural wastewater. It is estimated that 1 cubic meter wastewater can pollute 40 to 60 cubic meter fresh water (2).

Study area

Siyahroud River with about 28 km long and the average water discharge of 5.5 m3 per second are one the river in Sefidroud basin (8). This river basin area is about 82 km2. Siyahroud River is passed from the east part of Rasht and after joining to Goharud River named Pirbazar River and flows to Anzali international lagoon (3). Urban and industrial wastewater and discharging agriculture drainage in the river put the river in danger. In this research the water quality conditions of the river analyzed. The pollution sources introduced and the wastewater quality parameter values compare with the environmental standard ranges (4). Furthermore the effects of these factors in pollution of the river analyzed. The rivers discharge take into consider during 40 years period and the months that the discharge are less than the average determined to analyze the relation between pollution and the river's discharge. At the end some suggestions presented to joint of a section Sefidroud River to Syahroud for reduce the pollution and environmental impacts of pollutant.

The case study is shown on figure (1).

MATERIALS AND METHODS

Surface water pollution factors recognition

The source of Siyahroud River is fresh but along the river the pollution amount increase and after passing from Rasht city the pollution amount reach to the critical value because of discharging factories, urban and agricultural activities wastewater into the river. Figure (2) High amount of detergent pours to the river and after passing from Rasht, the river pass from rural area and fertilizer and chemical pesticides and furthermore the garbage and solid waste also pour to the river. Generally because of discharging the wastewater along the 28km of the river, the river's discharge reaches to several amount of initial discharge (5).

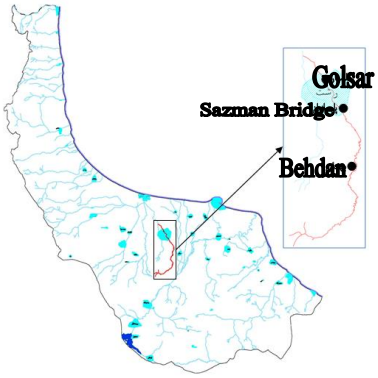

Figure 1. case study map

Figure 2. discharging the urban wastewater directly to the river

Industrial wastewater within the study area

The factories situations, the wastewater amount, quality parameters and the outlet of wastewater are so important. The industrial wastewater because containing the chemical parameters is so dangerous and is the main environmental polluter (6). In this regard wastewater data analyzed in 10 factories near the river within Rasht industrial city. The values of some of the quality parameters are shown in figures (3) to (8).

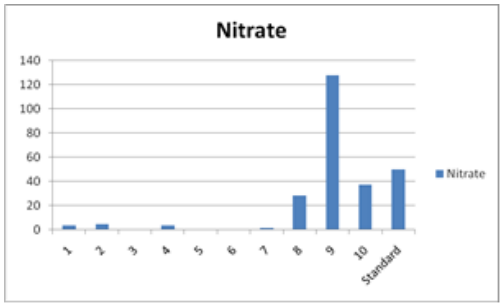

Figure 3. Nitrate values in 10 factories wastewate

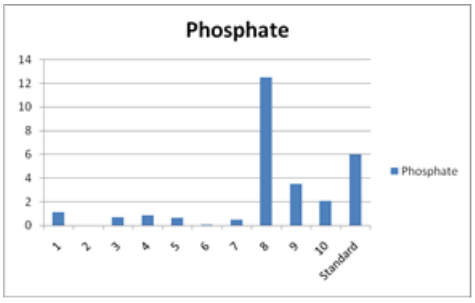

Figure 4. Phosphate values in 10 factories wastewater

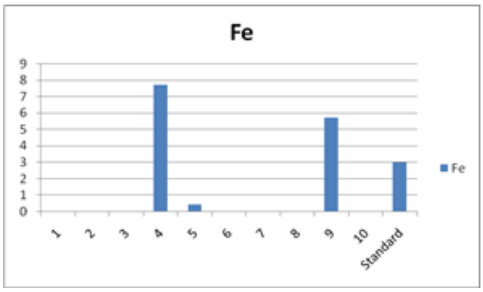

Figure 5. Fe values in 10 factories wastewater

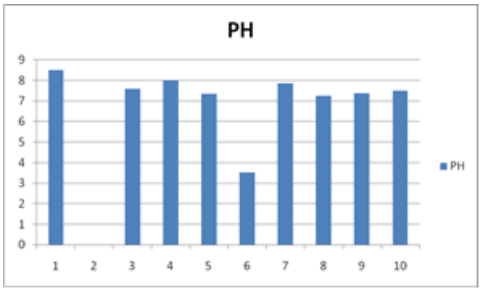

Figure 6. PH values in 10 factories wastewater

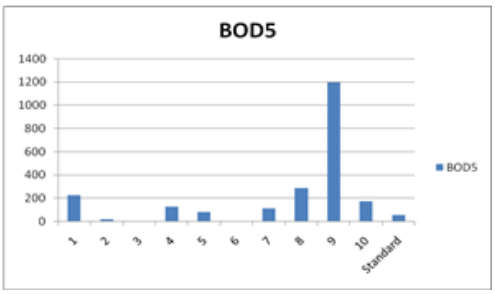

Figure 7. BOD5 values in 10 factories wastewater

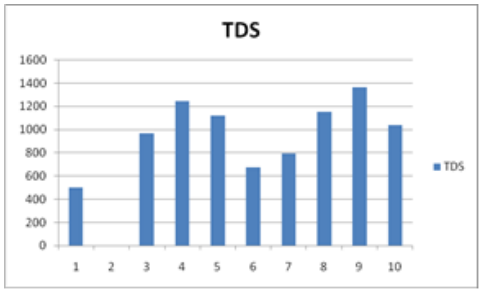

Figure 8. TDS values in 10 factories wastewater

As it can be seen in the graphs the value of nitrate in factory 9 is more than the permitted value to discharge to the surface water (50 mg/l) and the others are in the range (7). Phosphate value in factory 8 is more than the permitted value to discharge to the surface water (6 mg/l). Analyzing the Fe value shows this parameter in factories 4 and 9 is more than the permitted value. The results shows the quality parameters values in more than about 70% of the factories are more than the standard value. This subject determined that a wastewater treatment plant is required to treat the factories wastewater.

Urban and agricultural wastewater within the study area

In nearly all of the cities within the Province the most part of the collected wastewater from the domestic usage discharge to the river. In Rasht also the wastewater collects and discharges into Siyahroud River. In rural area also the agricultural activities drainage water reach to the river. The quality parameters during the past years in three stations along the river are shown on figures (9) to (12).

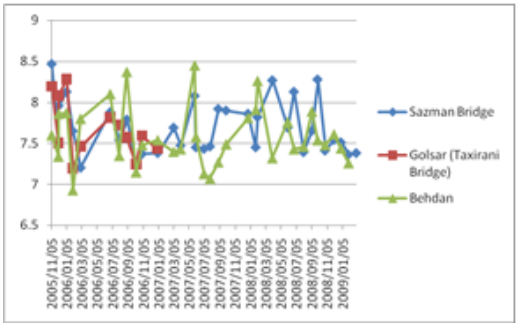

Figure 9. PH values during the past years

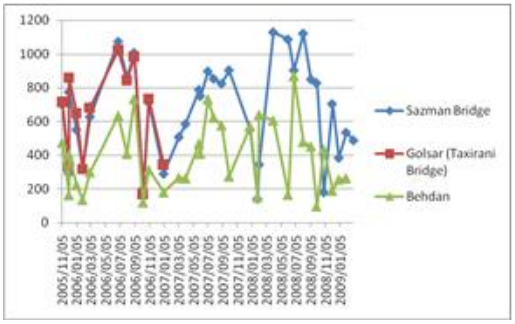

Figure 10. TDS values during the past years

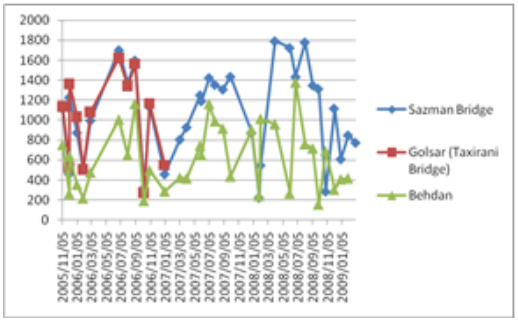

Figure 11. EC values during the past years

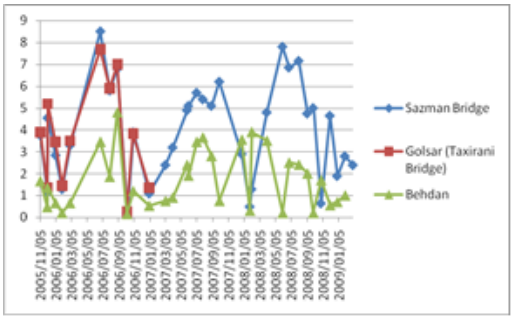

Figure 12. CL- values during the past years

The graphs show the fluctuation of the values during the different months. This behavior is depends to the river's discharge during the season and with decreasing the discharge in summer the pollution increase.

RESULTS AND DISCUSSION

The quality parameters in two stations near the outflow of urban wastewater and one station near the outflow of factories and agricultural wastewater analyzed and the results are shown in figures (13) to (20). The location of three stations is shown on figure (1).

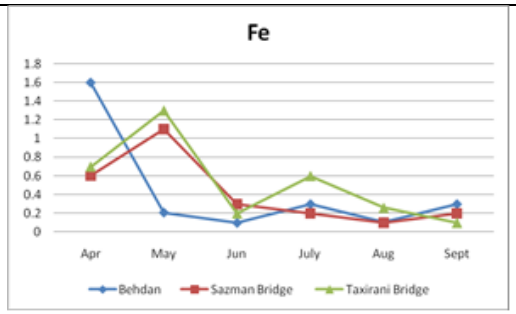

Figure 13. Fe values during the spring and summer

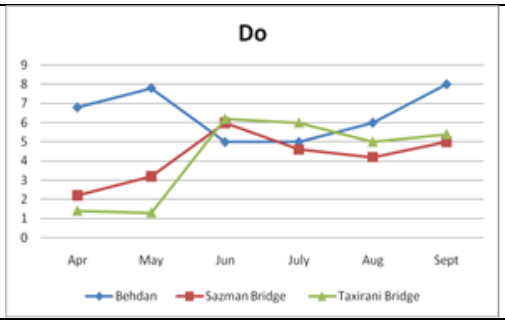

Figure 14. Do values during the spring and summer

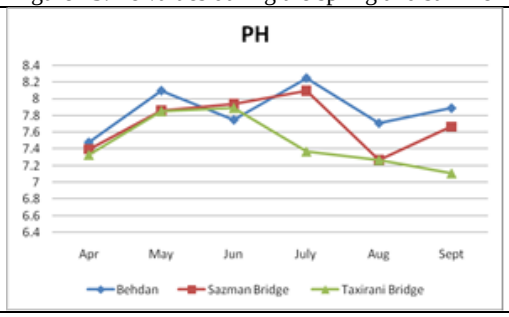

Figure 15. PH values during the spring and summer

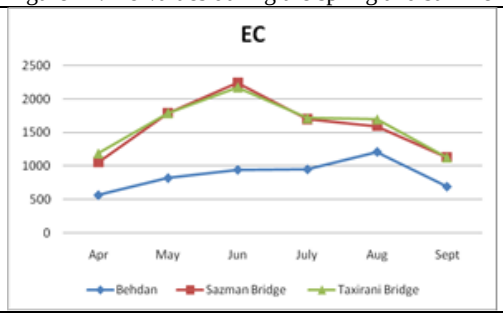

Figure 16. EC values during the spring and summer

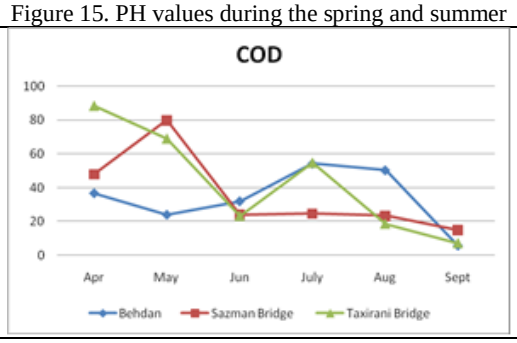

Figure 17. COD values during the spring and summer

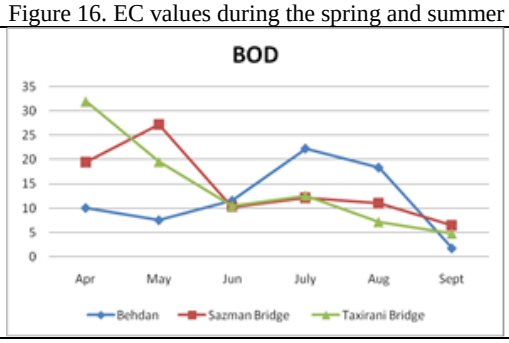

Figure 18. BOD values during the spring and summer

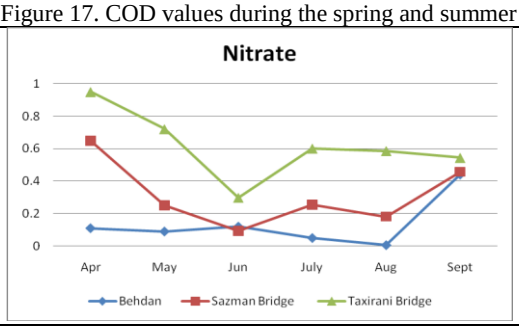

Figure 19. nitrate values during the spring and summer

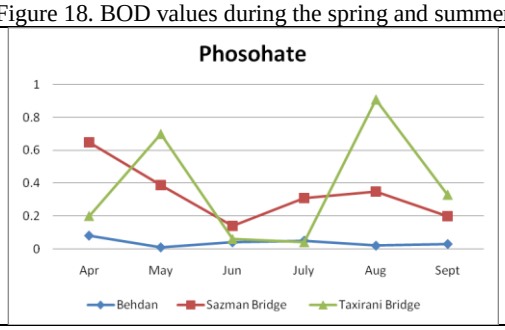

Figure 20. phosphate values during the spring and summer

As it can be seen in the table the maximum pollution values are DO and EC particularly in warm months. Most parameters have raising trend along the river and at the last station in addition to accumulate trend high amount of urban wastewater discharge to the river. The pollution trend of nearly all parameters are the same and the value of most parameters in May, Jun and July are greater than the others months. This is because the decrease of water discharge during these months and at the next part take into consider.

Control and reduce the polluter sources

According to the abovementioned analyses to reduce the river pollution the suggestions are as follow:

- Aeration the critical sections to supply the required oxygen and increase the oxidation
- Dilution the water with a less polluted water

Due to increase the river purification potential two factors: oxygen supply and reduce the pollution concentration are so important so must be take into consider for Siyahroud River. Of course after finish the construction of the wastewater treatment plant of Rasht City will reduce the pollution but it takes a long time.

- Step path in the city district

In this method after dredging the river, path stepped performs to supply the required oxygen to increase the river purification.

- Increase the discharge of the river

In this regards Siyahroud River's discharge analyzed in a 40 years period. According to the analyses of Siyahroud River's discharge in a 40 years period the discharge in four months includes: Jun, July, Aug and Sep are less than the average Table (1) and the discharge in the others months is more than or near the average. The average discharge is 5.5 cubic meter per second. Therefore if shortage in these 4 months supplies the river purification conditions will proved during these months.

Due to diluted and increasing the river purification potential the river discharge must be increase. Survey of the area shows that one source is the left channel of Sefidroud River that cross the river and could supply the water require. The location of the channel and recommended point is shown on figure (21).

Table 1. the river discharge during 40 years period

Mean	Sept	Aug	July	Jun	May	Apr	Mar	Feb	Jan	Dec	Nov	Oct	Water year
5.21	2.46	3.06	3.87	3.20	4.57	10.20	6.97	4.49	6.41	9.35	4.44	3.52	85-86
3.97	5.13	1.96	2.98	2.78	6.61	2.23	1.31	3.94	5.12	1.82	10.10	3.63	84-85
6.65	3.33	2.69	3.45	5.68	4.58	5.99	12.20	11.40	9.07	10.70	4.57	6.08	83-84
5.95	6.49	3.30	5.36	4.60	3.91	8.15	9.04	3.52	3.30	12.80	7.26	3.65	82-83
6.09	10.10	3.08	3.23	5.95	6.86	7.57	8.51	4.28	4.87	13.80	3.05	1.81	81-82
5.26	3.00	1.92	1.52	2.94	9.60	5.79	3.94	3.30	3.10	8.41	11.80	7.81	80-81
5.22	2.23	1.07	1.24	3.94	2.46	1.92	1.42	12.90	1.97	8.00	17.50	8.01	79-80
4.93	2.84	1.35	2.77	3.98	4.26	5.06	7.84	7.28	5.63	4.49	9.49	4.18	78-79
4.41	3.22	0.42	0.86	1.77	4.27	3.07	2.69	3.60	8.38	11.00	3.87	9.73	77-78
6.00	9.57	4.42	4.59	4.03	5.17	2.66	6.02	7.73	8.92	9.42	4.56	4.85	76-77
4.92	12.84	2.85	4.92	3.46	2.90	3.80	8.23	5.45	2.20	1.54	6.30	4.49	75-76
5.92	4.14	4.05	4.17	4.80	4.36	9.29	9.20	6.98	7.09	3.71	3.99	9.26	74-75
5.36	4.32	5.54	4.94	4.78	6.92	3.18	3.62	3.96	3.07	4.71	13.50	5.79	73-74
7.14	3.09	4.55	10.90	7.05	5.63	3.19	5.71	4.31	2.74	11.80	17.90	8.84	72-73
5.84	7.19	4.29	6.52	9.42	4.83	2.56	6.33	5.31	5.06	5.85	2.37	10.40	71-72
4.95	3.42	4.36	5.05	4.31	7.02	6.90	6.41	6.53	4.86	4.39	3.97	2.20	70-71
4.61	2.34	2.63	3.49	3.58	3.73	5.90	9.29	3.52	6.41	3.27	3.11	7.99	69-70
6.77	4.05	4.74	4.87	5.67	7.29	10.80	8.70	6.67	8.15	5.45	7.22	7.66	68-69
5.21	6.91	2.53	3.25	3.73	3.94	5.63	5.66	9.78	9.41	1.20	4.50	6.01	67-68
6.34	5.94	5.69	4.77	4.07	5.96	4.72	2.33	6.67	10.70	5.17	7.00	13.00	66-67
4.89	5.85	3.29	4.22	4.01	4.35	5.73	2.72	1.39	1.10	11.30	7.69	7.01	65-66
5.29	3.03	3.81	4.06	4.50	4.26	4.63	3.71	9.01	2.54	7.34	8.64	7.92	64-65
-	-	-	-	-	-	-	-	-	-	-	-	-	63-64
5.12	1.78	4.85	2.45	2.68	7.53	5.53	8.23	12.40	1.91	8.37	2.71	3.02	62-63
5.71	5.31	3.29	4.04	4.21	4.78	2.92	5.59	4.11	1.14	13.20	13.70	6.22	61-62
4.65	2.39	4.01	4.39	5.27	5.35	5.55	6.37	9.07	6.24	0.97	0.95	5.25	60-61
5.17	3.83	4.34	6.12	5.08	5.07	11.90	10.50	1.35	2.68	3.05	4.01	4.05	59-60
7.40	3.46	5.26	5.65	6.53	6.73	7.95	14.10	15.60	5.46	7.87	6.87	3.27	58-59
8.01	3.83	4.51	4.59	6.48	9.39	4.15	8.97	7.93	10.50	8.04	23.90	3.87	57-58
6.19	3.49	4.88	4.09	8.58	5.12	4.44	7.28	4.18	3.32	5.06	17.60	6.27	56-57
5.79	2.12	3.52	4.35	3.40	3.22	3.18	4.12	9.69	10.20	10.10	11.70	3.82	55-56
6.86	3.23	2.58	3.66	2.87	4.08	5.20	16.20	4.71	5.94	14.90	8.60	10.30	54-55
3.04	3.34	2.37	2.09	1.88	3.02	2.19	6.90	4.26	3.32	2.58	2.20	2.30	53-54
5.99	3.97	4.30	7.07	2.88	3.48	9.33	9.36	9.62	8.36	4.61	5.13	3.75	52-53
4.87	5.34	3.79	3.54	4.08	4.25	3.87	2.65	5.36	8.86	9.48	4.46	2.70	51-52
6.13	3.20	3.97	3.20	3.74	4.26	6.65	21.90	15.10	5.90	2.10	1.83	1.72	50-51
3.68	2.26	2.80	2.24	3.61	5.17	3.49	2.31	5.25	4.93	7.20	2.74	2.19	49-50
4.87	3.62	4.15	2.88	3.92	5.25	3.20	3.06	5.43	5.12	1.38	15.90	4.51	48-49
5.09	5.30	4.00	3.50	4.40	2.80	6.20	6.80	6.80	5.60	4.00	6.60		47-48
4.84	1.00	3.00	3.00	4.20	6.20	7.00	7.40	8.70	2.80	1.70	3.10	10.00	46-47
5.5	4.3	3.5	4.0	4.4	5.1	5.4	7.0	6.7	5.4	6.7	7.6	5.7	Mean
23.9	12.8	5.7	10.9	9.4	9.6	11.9	21.9	15.6	10.7	14.9	23.9	13.0	Max
0.42	1.00	0.42	0.86	1.77	2.46	1.92	1.31	1.35	1.10	0.97	0.95	1.72	Min

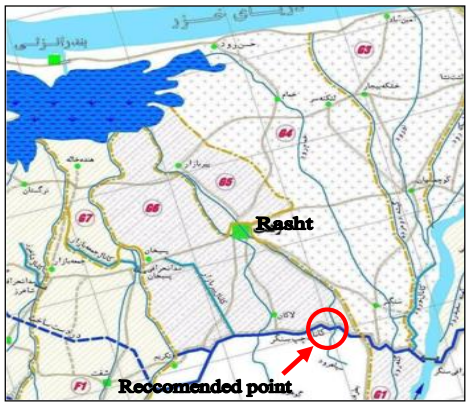

Figure 21. the recommended point to supply the water required

CONCULSION

The data analyzing of wastewater shows the quality parameters in most factories are more than discharge permitted values to the rivers. Therefore the treatment plants are needful within industrial cities in the province. Analyzing the municipal wastewater data that discharge to the river shows the similar condition so the wastewater must not directly discharge to the river. In this regard the finishing of wastewater treatment plant could be useful.

According to the data analyzing the pollution increase along the river that shows the deficit in purification potential. The river discharge along 40 years period and the pollution trend during the year shows the discharge in 4 months Jun, July, Aug and Sept are less than the average and the pollutions are increase in these months too. Therefore to reduce the impacts if water deficit trough these 4 months prepared from the suggested location that is left channel of the Sefidroud River purification potential in these months are increases and the pollution decrease in consequence.

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