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Comparison Coagulant Performance of Chloroferric and Polyelectrolyte (LT25) in Removing Organic Materials Turbidity in Raw Water Resources of Ardabil Treatment Plant

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ABSTRACT

Suspended and colloidal impurities in the water that cause color, odor, and taste are offensive in water, the necessary water treatment doubled. Therefore, coagulation and flocculation is used to remove them. One of the most important material is ferric coagulant in water treatment processes. To improve the performance of different coagulants from coagulant aid can be used. Given that the raw water surface water treatment plant Ardabil via funded and organic pollution load is high, the aim of this study was possible to remove more organic material biological contamination of raw water resource treatment plant is Ardabil to compare the performance of contract of polyelectrolyte LT25 with ferric chloride as a coagulant aid with ferric chloride as well as performance, the removal of organic contamination of ferric chloride and polyelectrolyte coagulant LT25 was used. To determine the amount of coagulant required and the optimum pH for coagulation practice jar test was used. The results of these studies as well LT25 polyelectrolyte coagulant aid compared with ferric chloride coagulant indicated as a polyelectrolyte LT25 reduces settling time and pH reduction was Fluke.

Keyword:
water treatment, organic pollutants and turbidity, coagulant, choloroferric, poly electrolyte

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Problem Statement:

In water treatment to remove turbidity, the nature of particulate matter in the water, in determining the appropriate type of coagulant, is very important. Coagulation process water treatment accounted for the largest share of the cost. So the ways in which it contributes to a further reduction of turbidity and organic matter efficiently and reduces the amount of coagulant and costs is of great importance (Abdollahzadeh, 2009). There suspended and colloidal impurities in the water that cause color, odor and unpleasant taste water, they suggest the need for water treatment. Therefore, coagulation and flocculation method used to remove them. Adding a coagulant to water neutralizes the charge of the colloidal particles, the particles get closer to both coarse and heavier particles are created. To complete the operation and development of clots than other substances used as coagulant aid. Resulting clots that colloidal particles and carry, and is large enough to be easily deposited and smooth. Metal salts as coagulant in water, the hydroxide, or hydroxides by hydrolysis to form ionic or charged, in the well. Creation of large charged molecules to neutralize the colloidal particles and reducing the zeta potential (voltage difference between dispersed phase and its environment) that the main cause repulsion between the colloidal particles, it is possible for the action of van der Waals force does not deteriorate causing particles stick to each is (Hosseinian, 2001). Crystalline powder or liquid ferric chloride in trade for one of the products sold coagulant in water treatment and sewage. One of the most important factors in clotting or coagulation of suspended solids and fine colloidal suspended material is water. As the particulate matter with a diameter of 0.2 to 5 microns that are much larger than the colloidal particles can be easily and coagulation sedimentation is very simple. In general, the higher the turbidity, easier so that coagulation in water with low turbidity is associated with many problems (APHA, 2005). Population growth, improve living standards, the development of urbanization and the development of industry and agriculture are among the factors that increase water consumption and wastewater production in communities and pollute the environment (Zanganeh, 2004). The most important factors affecting coagulation process efficiency: pH, ions in the aqueous solution, the concentration of humic materials, is water temperature and the type of coagulant (UNESCO, 2001). Impurities in the hydraulic cycle, human activities are added to the water can either be dissolved or suspended. Colloids are tiny particles suspended technically and often show many of the characteristics of soluble (PV, 1995). Polyelectrolyte polymer and electrolyte are the properties, the floc size can be larger. Polyelectrolyte into three groups: anionic, cationic and non-ionic their study. The advantages of the use of polyelectrolyte can be said to reduce the consumption of coagulant. They also concluded their plant and animal organisms (Abdullah Zadeh, 2010). 1 Jar testing to show the impact of chemicals in the treatment plant is designed. This test is a common method for the assessment of coagulation, flocculation, and sedimentation in the treatment plant. Jar testing is actually a small model Rapid mixing units, coagulation, and sedimentation at the treatment plant in this way adding chemicals, particularly materials such as alum, ferric chloride, polymers that are used to reduce water turbidity can be evaluated on a laboratory scale. With current tests, the operator can coagulant injection rate when turbidity, color Raw water quality and other index changes, the exact set according to the results of this test are set to inject chemicals into the treatment plant. There is usually based on experience, operators may add a few percent of the theoretical value obtained. It is also a useful tool to evaluate coagulant tests or new polymers (and compare them with each other) and even changes in coagulation and flocculation process using a mixing speeds change, change in the mechanism of settling, etc. (Susumma, 2000). Home coagulants for destabilizing particles and attach them to each other and help to increase density coagulant particles sticking together and helping to sink faster than they used to be (Banfield, 1982). The questions most sediment samples formed with the Compact or more compression and the clear supernatant is human. The optimum pH range is known to coagulant (Ammarluei, 2000). Abdollahzadeh et al. In 2010, the LT25 powder as anionic coagulant to remove turbidity proved to be very effective coagulant aid and reduce the use of ferric chloride in the coagulation process. The results of this study showed that the consumption of chemicals, using polyelectrolyte is effective. The use of ferric chloride to reduce the high pH it is possible. While the change in pH caused LT25 does so with less consumption of ferric chloride, lime juice consumption coagulant aid is reduced or minimized. Use Fluke formed LT25 increases the size and increase the speed of their settlement. It is important to lower opacities. The input to filter biological load decreases and the filtration process is more suitable in terms of compliance with environmental effects and reduce the frequency of cleaning the filter. Since ferric chloride solution containing heavy metals such as lead, mercury, cadmium, arsenic, etc., less consumption of this substance reduces the harmful effects of it as well. With regard to the treatment plant Ardabil is faced with the problem of biological and organic contamination found it. Therefore this research in order to exclude the possibility of biological contamination and loss of organic matter more than raw water resource input to the water treatment plant is Ardabil.

Methodology:

Introducing the Studied Region

Wiki country among the best modern treatment plant treatment plant so that the filtrate turbidity is lower than the standard range and quality of water delivered to subscribers of high utility and the treatment plant has a laboratory equipped with modern devices used by water quality experts continuously tested and Health Center of Ardabil as excellent observer to test and control the production of drinking water and water production and distribution network system Ardabil is just meters from systems in the Middle East. That the system in production and distribution of Ardebil, Ardebil tanks and residual chlorine in different parts online can be controlled by it. Raw water treatment plant for agricultural use and drinking Ardabil that will be provided. This dam with a capacity of 80 million cubic meters on the river 20 kilometers southwest of the city of Ardabil and one kilometer away from the village down Yamchi latitude 38 degrees north and longitude 48 degrees 4.5 minutes and 5 minutes East with the aim of Agriculture needs of 82 million cubic meters per year, providing part of the cost Ardabil to 20 million cubic meters per year and provide for protection of the environment by at least 1.5 million cubic meters of river have been built. As well as samples of the treatment plant in order to compare the performance of Ardabil city chloroferric coagulant and polyelectrolyte (LT25) for the removal of turbidity and organic material in raw water sources in 4 times during the seasons, sampling was carried out during the years 2013-2014. Sampling and testing Jar to 25 times on samples taken from raw water entering the treatment plant in accordance with standard procedures, edited 21 (EPA) was performed. To determine the optimum coagulant dose and optimum pH for coagulation action, jar test was used.

Results

Results analyzed data ferric coagulant article

Table 1: Dose of ferric chloride coagulant in winter

Tiff raw water : 22.35 NTU				Time trial: Winter 11.22.2013			
Temperature of raw water: 11.2 ° C				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	8	9	10	11	12	23
2	Lime	-	-	-	-	-	-
3	Polyelectrolyte	-	-	-	-	-	-
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	6.35	5.59	4.45	3.71	3.3	3.19
7	pH after testing	7.89	7.84	7.8	7.75	7.72	7.67
8	Fluke type	Fine	Fine	Fine	Fine	Average	Good

Table 2 ferric coagulant dose rate in spring

Tiff raw water : 22.35 NTU				Time trial: Winter 11.22.2013			
Temperature of raw water: 11.2 ° C				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	8	9	10	12	13	14
2	Lime	-	-	-	-	-	-
3	Polyelectrolyte	-	-	-	-	-	-
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	4.68	4.57	3.84	3.48	3.27	3.15
7	pH after testing	7.93	7.87	7.82	7.79	7.77	7.7
8	Fluke type	Fine	Fine	Fine	Fine	Average	Good

Table 3 shows the dosage of ferric chloride coagulant in summer

Tiff raw water : 22.35 NTU				Time trial: Winter 11.22.2013			
Temperature of raw water: 11.2 ° C				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	7	8	9	10	12	13
2	Lime	-	-	-	-	-	-
3	Polyelectrolyte	-	-	-	-	-	-
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	6.12	5.59	4.82	3.77	3.31	3.18
7	pH after testing	7.91	7.88	7.85	7.83	7.79	7.77
8	Fluke type	Fine	Fine	Fine	Fine	Average	Good

Table 4 shows the dose of ferric chloride coagulant in autumn

Tiff raw water : 22.35 NTU				Time trial: Winter 11.22.2013			
Temperature of raw water: 11.2 ° C				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	8	9	10	11	12	13
2	Lime	-	-	-	-	-	-
3	Polyelectrolyte	-	-	-	-	-	-
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	5.36	4.82	4.11	3.85	3.3	3.15
7	pH after testing	7.82	7.8	7.8	7.75	7.71	7.68
8	Fluke type	Fine	Fine	Fine	Fine	Average	Good

In winter, the turbidity of raw water to the amount of 22.35 NTU and pH raw water 8.20 mg per liter jar test was used for the conclusion of the action. The current system of human 6 liter was prepared, and the sample is poured evenly in all the beakers. To every man some of ferric chloride per liter respectively 8 mg, 9 mg per liter and 10 mg per liter, 11 mg per liter and 12 mg per liter and 13 mg per liter was injected and after two minutes of mixing rapid mixing with 140 rpm and 20 minutes at 40 rpm was quiet. After settling time (40 minutes) Jar samples were analyzed immediately. Finally, after measuring turbidity human samples with turbidity (6) 3.19 NTU and the anticoagulant 13 milligrams per liter and pH 7.67 milligrams per liter with good Flock size was chosen as optimal for injection (Table 1). To determine the optimal dose of coagulant necessary in the spring, with the amount of raw water turbidity 5.96 NTU and pH raw water 8.22 mg per liter jar test was used for the conclusion of the action. Results jar with concentrations of 8, 9, 10, 12, 13, 14 mg per liter ferric chloride showed a man with opacity (6) 3.15 NTU and the anticoagulant 14 milligrams per liter and pH 7.70 milligrams per liter with good Flock size was chosen as optimal for injection (Table 2). To determine the optimal dose of coagulant required in the summer, raw water turbidity at 28.65 NTU and pH raw water 8.20 mg per liter jar test was used for the conclusion of the action. Results ferric chloride at a concentration of 7 mg per liter, 8 milligrams per liter, 9 milligrams per liter, 10 mg per liter and 12 mg per liter and 13 mg per liter showed a man with opacity (6) 3.18 NTU and the anticoagulant 13 milligrams per liter and pH 7.77 milligrams per liter with good Flock size was chosen as optimal for injection (Table 3). To determine the optimal dose of coagulant necessary in the autumn, with the amount of raw water turbidity 22:35 NTU and pH raw water 8.20 mg per liter jar test was used for the conclusion of the action. Results ferric chloride concentration of 8 milligrams per liter, 9 milligrams per liter, 10 mg per liter, 11 mg per liter and 12 mg per liter and 13 mg per liter determined man with opacity (6) 3.15 NTU and the anticoagulant 13 milligrams per liter and pH 7.68 milligrams per liter with Fluke as well as optimal for injection (Table 4).

The results of data analysis with the help of the coagulant ferric coagulant polyelectrolyte

Table 5: Shows the ferric coagulant dosage of polyelectrolyte in winter

Tiff raw water : 22.35 NTU				Time trial: Winter 02.07.2014			
Temperature of raw water: 11.2				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride With polyelectrolyte			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	6	7	8	9	10	11
2	Lime	3	3	3	3	3	3
3	Polyelectrolyte	0.02	0.02	0.02	0.02	0.02	0.02
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	5.27	4.8	3.44	3.29	3.17	3
7	pH after testing	7.81	7.77	7.75	7.73	7.72	7.7
8	Fluke type	Fine	Fine	Fine	Average	Good	Excellent

Table 6. The ferric coagulant dose of polyelectrolyte in the spring

Tiff raw water : 22.35 NTU				Time trial: Winter 02.07.2014			
Temperature of raw water: 11.2				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride With polyelectrolyte			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	6	7	8	9	10	11
2	Lime	4	4	4	4	4	4
3	Polyelectrolyte	0.02	0.02	0.02	0.02	0.02	0.02
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	3.96	3.71	3.28	3.17	3	2.89
7	pH after testing	7.88	7.83	7.74	7.72	7.74	7.71
8	Fluke type	Fine	Fine	Fine	Average	Good	Excellent

Table 7 shows the amount of ferric chloride coagulant dosage of polyelectrolyte summer

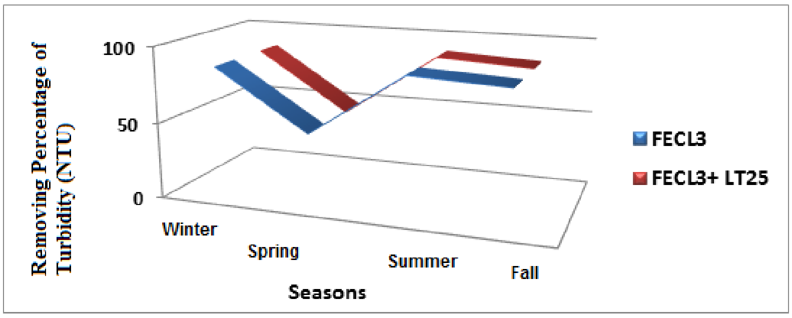
Tiff raw water : 22.35 NTU				Time trial: Winter 02.07.2014			
Temperature of raw water: 11.2				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride With polyelectrolyte			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	6	7	8	9	10	11
2	Lime	4	4	4	4	4	4
3	Polyelectrolyte	0.03	0.03	0.03	0.03	0.03	0.03
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	4.77	4.56	3.71	3.54	3.29	3.16
7	pH after testing	7.81	7.8	7.73	7.72	7.68	7.68
8	Fluke type	Fine	Fine	Fine	Average	Good	Excellent

Table 8 shows the amount of ferric chloride coagulant dosage of polyelectrolyte in the fall

Tiff raw water : 22.35 NTU				Time trial: Winter 02.07.2014			
Temperature of raw water: 11.2				The sampling tube input transmission line to the treatment plant			
pH raw water: 8.20				Article anticoagulant: ferric chloride With polyelectrolyte			
Row	Current issue Substance	1	2	3	4	5	6
1	Ferric	6	7	8	9	10	11
2	Lime	2	2	2	2	2	2
3	Polyelectrolyte	0.02	0.02	0.02	0.02	0.02	0.02
4	Bentonite	-	-	-	-	-	-
5	pH regulation	-	-	-	-	-	-
6	The final turbidity	4.17	3.68	3.31	3.2	3.02	2.98
7	pH after testing	7.88	7.8	7.77	7.7	7.68	7.68
8	Fluke type	Fine	Fine	Fine	Average	Good	Excellent

To determine the optimal dose of coagulant concluded with the help of (ferric chloride and polyelectrolyte) required in the winter, with the amount of raw water turbidity 22.35 NTU and pH raw water 8.20 mg per liter jar test was used for the conclusion of the action. To each beaker is then added to the amount of 3 milligrams per liter. Ferric chloride injection, respectively, 6, 7, 8, 9, 10, and 11 mg per liter were done by mixing fast and slow. During the slow mixing 0.02 mg per liter was added polyelectrolyte coagulant aid. The results showed that the optimum concentration of ferric chloride 10 mg per liter of ferric chloride is a concentration of 10 milligrams per liter. The 3.17 NTU turbidity and pH 7.72 milligrams per liter of support signed by polyelectrolyte LT25 at doses of 0.5, 0.04, - 0.03, 0.02 more questions concentration of 0.02, respectively (Table 5). To determine the optimal dose of coagulant concluded with the help of (ferric chloride and polyelectrolyte) necessary in the spring, 5.96 NTU turbidity, and pH value of raw water raw water 8.22 mg per liter to act the conclusion of the current experiment with the amount of 4 milligrams per liter is then used in human. Ferric chloride concentrations, respectively, 6, 7, 8, 9, 10, and 11 milligrams per liter injection and mixing at a temperature of 12.3 ° C were quick and quiet. While mixing slowly to every human value of 0.02 milligrams per liter help coagulant (polyelectrolyte) were selected as the optimal dose. After settling time (40 minutes) Jar samples were analyzed immediately. Finally 3.17 NTU turbidity and pH value 7.72 milligrams per liter in humans (4) the amount of ferric chloride was injected 9 mg per liter, respectively. It also concluded from the material help of polyelectrolyte doses of 0.5, 0.04, 0.03, 0.02 concentration of 0.02 showed a greater response (Table 6). To determine the optimal dose of coagulant concluded with the help of (ferric And polyelectrolyte) required in the summer, the turbidity of raw water to the amount of 28.65 NTU and pH raw water 8.20 mg per liter jar test was used for the conclusion of the action. Human lime to select the optimal dose of 4 milligrams per liter equally to all mankind was added and then of ferric chloride, respectively 6, 7, 8, 9, 10 and 11 milligrams per liter injection and rapid mixing at a temperature of 18.2 ° C for two minutes at 140 rpm and 40 rpm were gentle mixing for 20 minutes while stirring gently every human the amount of 0.03 mg per liter help coagulant (polyelectrolyte) was selected as the optimal dose was added. After settling time (40 minutes) Jar samples were analyzed immediately. Finally, turbidity and pH value of NTU 3.16 7.68 milligrams per liter in the amount of ferric chloride injection 11 mg (6) Human liter respectively. It also concluded from the material help of polyelectrolyte doses of 0.5, 0.04, 0.03, and 0.02 was used at a concentration greater response was 0.03 (Table 7). To determine the optimal dose of coagulant concluded with the help of (ferric chloride and polyelectrolyte) necessary in autumn, raw water turbidity and pH value of 22.35 NTU raw water 8.20 mg per liter jar test was used for the conclusion of the action. Human lime jar test to select the optimal dose of 2 mg per liter beakers were added equally to all of ferric chloride, respectively, 6, 7, 8, 9, 10 and 11 milligrams per liter injection at a temperature of 11.2 ° C rapid mixing and mixing was done. While mixing slowly to every human value of 0.02 milligrams per liter help coagulant (polyelectrolyte) was selected as the optimal dose was a tiny added? After settling time (40 minutes) Jar samples were analyzed immediately. Finally 3.20 NTU turbidity and pH value 7.70 milligrams per liter in humans (4) the amount of ferric chloride was injected 9 mg per liter, respectively. It also concluded from the material help of polyelectrolyte doses of 0.5, 0.04, 0.03 0, 0.02 was considered to be the better solution was 0.02 (Table 8).

Removing Percentage of Turbidity

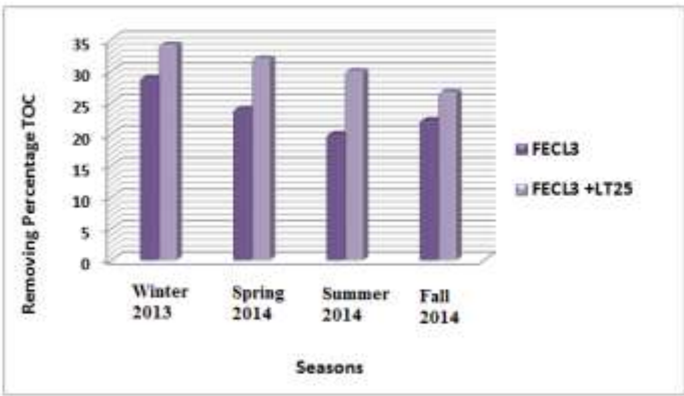


Type of expenditure	Winter 2013	Spring 2014	Summer 2014	Fall 2014
FECL3	85.72	47.14	88.90	85.90
FECL3 + LT25	85.81	46.81	88.97	85.68

Figure 1: Percent of turbidity NTU In two cases, ferric chloride, and ferric chloride alone using coagulant aid LT25

Figure 1 percent of turbidity NTU Ferric chloride and ferric chloride residual and turbidity using coagulants with help LT25 Opacity obtained in the four seasons (winter, spring, summer, autumn) with ferric chloride coagulant function with the help of polyelectrolyte coagulants showed that, because of high turbidity in the summer using ferric chloride coagulant increases turbidity and temperature increases in turbidity and turbidity removal rate in the summer than other seasons more.

Removing Percentage TOC



Type of expenditure	Winter 2013	Spring 2014	Summer 2014	Fall 2014
FECL3	28.94	24	20	22:22
FECL3 + LT25	34.21	32	30	26.66

Figure 2: Compares the performance of coagulants and ferric chloride and ferric chloride alone polyelectrolyte coagulant aid with removal of TOC

TOC removal rate achieved in the four seasons (winter, Spring, Summer, Fall) Suggests that the removal rate of TOC in polyelectrolyte coagulant ferric coagulant with more and better aid, ie on average in four seasons with the removal of ferric coagulant coagulant aid polyelectrolyte 6.92 mg liter more and better ferric coagulant to remove the organic matter carried out (Figure 2).

Conclusion

The results of this study good performance polyelectrolyte LT25 As a coagulant aid compared with ferric chloride coagulant indicated as a polyelectrolyte LT25 Reduces settling time and reduced Fluke pH, respectively.

Research Suggestions

1. It is recommended that if possible increase of raw water turbidity is less than the amount of ferric chloride and polyelectrolyte used.
2. It is proposed given that the ferric reducing the pH of the water and reduce water pH increases the amount of dissolved iron in water is better than other material like poly aluminum chloride PAC used.
3. It is recommended that the use of ferric chloride in water entering the treatment plant of month that has a different opacity and quality will be further investigated.
4. It is recommended to use a coagulant (ferric chloride) that is economically reasonable compared to other conventional coagulants.

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