The effect of using Coagulants and Coagulants Aid (Porcelanite and Silica Jel) in improving water efficiency treatment .

Arkan Dhari Jalal
Dams and Water Resource Department
College of Engineering - University of Anbar

ABSTRACT.

Many studies were achieved in order to improve water efficiency treatment and to remove high turbidity by using Coagulants like Alum with Coagulants aid like polymers. Many researches explain the effect of these polymers on the removal of high water turbidity over the past years attempting to improve the coagulation and flocculation processes.
Several experiments were performed to investigate the effect of using other types of coagulants aid on the percentage removal of turbidity and to find the optimum dosage of coagulant (alum) and coagulant aid. The coagulants used in this study were alum, Porcelanite and Silica Gel which are used in general company of ceramic and glass factory in Ramadi City as liquid state .The initial turbidity at 450 NTU was used with floc growth and floc formation was studied for Kaolinite 10 µm particles size.
The results were obtained and plotted to show the effect of using different dosages of the mentioned coagulants on the residual and percentage removal of turbidity. Also, other parameters like TDS, Ec, pH and salt were calculated. The results indicated that the efficient coagulant type with dose of 30 mg/l is 4.56 NTU residual turbidity and removal percentage of 98.98% by using alum with silica, with the percentage of alum is 60% and 40% of Silica and pH value 7.66.

Keywords: Water, Coagulation, Turbidity, Treatment, Removal.

1. INTRODUCTION.

In this research, the effect of coagulation process upon water treatment efficiency for turbidity removal will be discussed.
The separation of suspended solids from river water has been the subject of many investigators over the past years. It is usually achieved by conventional treatment through coagulation – flocculation, sedimentation and filtration units. In all of these operations, the removal efficiency is greatly dependant on particles size, and can usually be enhanced by aggregation of fine particles in the coagulation flocculation sequence.
Removal of turbidity by coagulation depends on the nature and concentration of the colloidal contaminants; type and dosage of chemical coagulant; use of coagulant aids; and chemical characteristics of the water, such as pH, temperature, and ionic character. In water treatment practice, chemical coagulation and flocculation are also considered to depend on physical processes. Choice of coagulant dosage, pH, and coagulant aids are related to the mixing process of promoting aggregation of the destabilized colloids. The efficiency of the coagulation – flocculation system depends on subsequent settling and filtration**.** [1]

2. MECHANISM OF COAGULATION.

Although chemical coagulation is a widely used process then mechanisms of operation is not fully understood in spite of considerable research effort. Basic colloid stability considerations have been applied to coagulation in attempts to offer explanations for the observed results.
A natural force of attraction exists between any two masses (Van der Waals force). Random motion of colloids (Brownian movement), caused by bombardment of water molecules, tends

to enhance this physical force of attraction in pulling the particles together .The purpose of chemical coagulation in water treatment is to destabilize suspended contaminants such as particles contact and agglomerate, forming flocs that drop out of solution by sedimentation[2]. The addition of chemical coagulants induces agglomeration. The chemicals reduce colloidal surface charge and form precipitates that enhance the clustering process and sedimentation The addition of coagulants containing divalent or trivalent cations can both reduce negative surface charge and form a precipitate to trap additional particles. The reduction in the electrostatic repulsion is shown in **Fig. (A).** [3].
The principle phenomena controlling the behavior of colloids are electrostatic forces, Van der Waals forces, and Brownian motion. The surface charge of the colloids attracts ions of opposite charge, known as counter ions. These ions, which include hydrogen and other cat ions, form a dense layer adjacent to the particle known as stern layer .The fixed layer or stern layer is the tight compact layer of counter ions that surrounds the particle,. [4].
The Coagulation is also called destabilization. It is usually achieved by the addition of chemical reagents which by bonding or adsorption mechanism nullify the repulsive forces or act on the hydrophily of the colloidal particles, ie .it is a chemical addition process, [5].
Chemicals can be used to create changes in pollutants that increase the removal of these new forms by physical processes. Simple chemicals such as alum, lime or iron salts can be added to wastewater to cause certain pollutants, such as phosphorus, to floc or bunch together into large, heavier masses which can be removed faster through physical processes, [6].

3. TYPES AND DOSES OF COAGULANTS.

There are many chemical materials used as coagulant so , The coagulants can be classified as Primary Coagulant such as : Aluminum Sulphate.(Alum) .$Al_2(SO_4)_3.18H_2O$, Aluminates Sodium .$NaAlO_2$,Ferric chloride. $FeCl_3.6H2O$, Ferric Sulphate .Fe_2 $(SO_4)_3.7H_2O$, $FeSO_4.7H_2O$ and coagulant aid such as: Activated Silica and coagulation materials (Lime stone, Activated Carbone, etc), [7].
The coagulation processes achieved by adding one chemical material or more and the coagulant dose depend on the characteristics of polluted water by turbidity .Therefore the dosage of coagulant must be measured daily at least and the doses of coagulant can be calculated by Jar Apparatus, [8].
The correct coagulants dosages is determined initially from Jar-Tests of the raw water, and then modified by actual plant operation experience. Optimal floc formation using alum occurs when the pH value of the water is between 6 and 8, [9].
Chemical coagulation , an operation of chemical treatment in which floc-forming chemical are added to water for the purpose of enmeshing or combining with settle able, but more particularly with non-settleable suspended matter. Rapidly settling aggregates (flocs are created. The added chemicals called coagulants are soluble, but they are precipitated by reacting with substances in or added to the water. The most common coagulants are aluminum and iron salts, [10].
Aluminum sulphate (alum) has been widely used as inorganic coagulant to destabilize naturally occurring particles, [11] and [12] observed that high turbidity water need large quantity of alum and even so the required water specification would not be achieved.

4. EXPERIMENTAL WORK.

All experiments were done in the Environmental Lab of the College of Engineering in Al-Anbar University.

4. 1 .Apparatus

The main apparatus used in this work includes:

- Multiplace flocculation stirrer (Jar Test),**Photo(1).**
- Laboratory Turbiditymeter to measure Turbidity in Nephelometric Turbidity units(NTU),**photo(2)**.
- Magnetic Stirrer.
- Balance 210 gm ,**photo(3)**.
- pH meter
- To measure conductivity E.C, Salt and TDS, **photo(4).**

4.2. Coagulants Used.

4.2.1 .Alum.

The Iraqi alum or (local alum) is used in this study. The aluminum sulfate used in these experiments as coagulant has the chemical formula of [AL2 (SO4)3.18H2O].

4.2.2. **Coagulant Aid (Porcelanite Powder).**

Mineralogy Local material of porcelanite was used as coagulant aid .The porcelanite powder was supplied from the General Establishment for Geological Survey and -Ministry of Industry and Minerals (GEGSM). The chemical and physical analysis of the porcelanite is shown in **Table (1).**

4.2.3. Coagulant Aid (Silica Gel)

In this study Sodium Silicate (Silica Gel) or (Silica Gum) $Na_2O.2SiO_2$ in Liquid State was used as coagulant aid to remove turbidity in the water treatment by Jar-Test with different doses and percentages comparison with results of porcelanite .This Chemical material can be produced by General Company of Glass and ceramic industrial in Ramadi City and used as main material in Glasses Factory. The chemical analysis was done to this material by Glass Factory and the chemical analysis was as following in the **Table (2).**

4.3. Kaolinite Clays.

The turbidity material used in the experimental work is from kaolinite .**Table (3)** presents the chemical analysis of kaolinite used in this study. Kaolinit has been supplied from Ceramic Factory in Ramadi City and the chemical analysis was performed in this Factory.

4.4. Experimental Procedures.

Experiments were performed using the conventional Jar Test procedure. The samples of water with high turbidity of 450 NTU were collected for experimental work .The samples were transferred to jar test apparatus immediately and Different dosages of aluminum sulphate, porcelanite and Silica Gel were added to the water. The contents was stirred rapidly for (60 sec), with rotating speed (250 rpm) ,then the contents were mixed slowly for (15 min)with rotating speed of (50 rpm) .The sedimentation time flocs were allowed to settle (30min), then it was possible to determine the optimum dosage of coagulant ,[13],[8].

In this study alum and alum with porcelanite and then with Silica Gel were added with different dosages of (15, 20, 25, 30, 35, 40) mg /l. Settling periods also varied depending upon the coagulant dose. At the end of the settling period, samples of 100 ml were withdrawn from 1cm below the liquid surface by means of suction apparatus connected to a vacuum source .The residual turbidity was measured to determine removal percentage of turbidity. The alum used with coagulant aid (porcelanite, Silica) materials with the different percentage

is shown in **Tables (4) and (5)** .These percentages were used for all dosages added in this study. The above procedure was repeated for each coagulant aid and for each percentage of coagulant aid.
Koalinit sample 10 µm particle size was added 1000 ml of distilled water with the action of rapid mixing on a magnetic stirrer .This sample was prepared for the study of floc formation by measuring the floc size .The chemical analysis of kaolinite used in this study was present in **Table (3)** .Therefore the above procedure was repeated by using koalinite sample as suspended solid in distilled water.

5. RUSELTS AND DISCUSSION.

Tables (6, 7 and 8) show the results of experimental work .These results were plotted between different parameters like Residual and percentage of removal for turbidity and PH against different types of coagulant with different doses as observed through the Jar-Test as shown in **figs. (1 - 30)**. Initial values of the Parameters were as follow: **(Turbidity= 450 mg/l , PH= 7.5, salt =0.4, E.C =1235 µ.s/cm and TDS= 590 mg/l).**
The present work has been devoted mainly to study the effect of using different coagulant doses in the removal percentage of initial turbidity of 450 NTU, PH, salt, E and TDS. Also, the work studied the effect of using different types of Coagulants aid (Porcelanite and Silica) on the above parameters.

5.1. Effect of coagulant type on turbidity removal.

Figs.(1, 2, 6 and 7) show the performance of various types of coagulants in treating water of 450 NTU Turbidity with different doses of Alum , porcelanite and Silica with percentage of 100 % respectively . **Fig. (1)** showed that the final residual turbidity is 13 NTU and removal percentage was 97% with dose of 40mg/l by using Alum with percentage of 100%.While **Figs**.**(3, 4, 5, 15,16 and 17),**showed the results of residual turbidity NTU with their Removal percentage by using Porcelanite Coagulant aid with different percentage of 50%, 40% and 25 % with Alum , where the final residual turbidity was 7.51 NTU and removal percentage of 98.33% with dose of 30 mg/l of 75% Alum as shown in **Figs. (5) and (17)**.The porcelanite coagulant aid has improved separation of suspended solids as expected and recorded in. [4].
Figs. (8,9,10,18,19 and 20), Shows the results of residual turbidity NTU with their removal percentage by using Silica Coagulant aid with different percentage of 50%, 40% and 25 % with Alum, where the final residual turbidity was 4.56 NTU and removal percentage of 98.98% with dose of 30 mg/l of 60% Alum as shown in **Fig. (9)** and **(19)** respectively.
It is very clear from the above figures that Alum in conjunction with 18mg/l and silica with 12mg/l has as shown in **Figs. (9)** and **(19)** has the favorable performance and can be regarded as the best Coagulant, because this coagulant has gave little residual turbidity that water can be treated.

5.2. Effect of Coagulant Type on pH.

The initial pH of raw water is 7.5, from the above results and **Figs. (21)** to **(30)** indicate that there is no more change in PH value in case of using Alum alone with percentage of 100%. Also, there is no more change in case of using Porcelanite and Silica as coagulant aid with Alum with percentage of 50%, 60% and 75%. But we observe little change in PH in case of using Poreclanite alone with percentage of 100%.The high value of pH of (9.05) was recorded when the Silica was used alone (390 mg/l) with percentage of 100 % .

Other parameters like TDS, E.C and Salt there is no more change in their values, therefore these values do not affect on the efficiency of water treatment .The main Values which represent different types of coagulants with different percentages have more effect on the performance of removal percentage of water turbidity and pH.

6. CONCLUSION AND RECOMMENDATION.

1- High turbidity water can be removed with high percentage by using Silica as coagulant aid with 60% of Alum, where the values obtained were: final turbidity 4.56NTU, Removal percentage 98.98%. And this value of turbidity agrees with Iraqi specification for potable water, [14].

2- the performance of Alum in case of using it alone is not recommended because it gives Final turbidity more than if it is used with other coagulants like Silica and porcelanite with different percentages that can reduced the cost of Alum.

3- The increasing dosages of coagulants with different percentages have effective influence on reducing of the final water turbidity.

4- The increasing in the dosages values of the Silica Coagulants increased the value of PH especially if the Silica used alone with 100% percentage.

5- There are no more changes in the values of TDS, Ec and Salt after the coagulants (Silica jel and Porcelanite) have been added.

6- It can be recommended to perform future studies with the same coagulants (Silica and Porcelanite) but with different values of high initial water turbidity for example, 1000 NTU, 2000NTU and 3000 NTU.

7. REFERENCES.

[1] Warren Viessman ,Jr and Mark J. Hammer ," Water Supply and Pollution Control" 4th edition ,Harper and Row, Publisher ,Inc. , 1985.

[2] Mark J.Hammer, "Water and Wastewater Technology) 2nd edition .John Wiley and SonsInc, NewYork, 1986.

[3] Bill T.Ray., "Environmental Engineering" Southern Illinois University, Carbondale .PWS Publishing Company adivision of International .T homson publishing Inc., 1995.

[4] Rasha.A.Taha , " Effect of Using of Porcelanite on the Performance of Water and Wastewater Treatment" Msc Dissertation. University of Babylon,2007.

[5] Degremont, “Water Treatment Handbook”, Vol. 1, sixth edition, Lavoisier Publishing, Paris, 1991.

[6] Tebbutt .T.H.Y,"principles of water Quality Control" Butter Worth-Heinmam. Pub. CO, 1998.

[7] د.عصام محمد عبد الماجد احمد، "الهندسة البيئية"و كليه الهندسة، جامعه السلطان قابوس، دار المستقبل للنشر والتوزيع، 1995.

[8] د.محمد صادق العدوي ، "هندسه الامداد بالمياه-هندسه صحيه(1)"،كليه الهندسه-جامعه الاسكندريه، الناشر:منشأه المعارف، جلال حزي وشركاه، 2005 .

[9] Cristopher R. Schulz and Daniel A.Okun , "Surface Water Treatment for Communities in Developing Countries" Dept .of Environmental Eng. School of Public Health , University of North Carolina. John Wiley and Sons, Inc., 1992.

[10] Dr. BAL Jeets. Kapoor, " Environmental Engineering an Overview", Dept .of Civil Eng .Punjab Eng College. Chandigarh, Khanna Publishers, 1989.

[11] Robinson,C.N ," Polyelectrolyte as Primary Coagulants for Potable water System" J.AWWA, 1974.

[12] Cohen, and et al, "Natural and Synthetic Polyelectrolytes as Coagulants Aids",J.AWWA, 1958.

[13] Casey,T.J,"Unit Treatment Processes in Water and Wastewater Engineering" Jhon Willet and Sons Pub.Co, 1997.

[14] سعاد عبد عباوي ومحمد سليمان حسن ،"الهندسة العملية للبيئة –فحوصات الماء"جامعه الموصل، دار الحكمة للطباعة والنشر،1990.

Table (1): Chemical And Physical Analysis of Porcelanite Used in This Study, (GEGSM).

Chemical Composition %	SiO_3	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5	CaO	MgO	Na_2O	K_2O
	84.57	**0.59**	**4.34**	**0.021**	**1.64**	**1.57**	**0.56**	**0.18**	**0.22**

Table (2): Liquid State Specifications of Sodium Silicate (Silica Gel).

Liquid State Specifications of Sodium Silicate(Silica Gel)	
Chemical Composition	**Standard Composition**
Specific Gravity	**1.5±0.05**
SiO_2	**32±6%**
Na_2O	**14±2%**
Ratio(SiO_2/Na_2O)	**2.4±0.4**

Table (3): Chemical Analysis of Kaolinite Used.

CaO %	TiO2 %	Fe2O3 %	SiO2 %	Al2O3 %	Mgo%
0.31	**0.89**	**1.15**	**46.08**	**35.29**	**0.34**

Table (4): Summery of Coagulant Dosages of (Alum and Alum +porcelanite).

Set No.	Dosage of coagulant mg/l	Percentage of alum %	Dosage of alum mg/l	Percentage of Porcelanite %	Dosage of porcelanite mg/l
1	15	100	15	0	0
	20	100	20	0	0
	25	100	25	0	0
	30	100	30	0	0
	35	100	35	0	0
	40	100	40	0	5
2	15	50	7.5	50	7.5
	20	50	10	50	10
	25	50	12.5	50	12.5
	30	50	15	50	15
	35	50	17.5	50	17.5
	40	50	20	50	20
3	15	60	9	40	6
	20	60	12	40	8
	25	60	15	40	10
	30	60	18	40	12
	35	60	21	40	14
	40	60	24	40	16
4	15	75	11.25	25	3.75
	20	75	15	25	5
	25	75	18.75	25	6.25
	30	75	22.5	25	7.5
	35	75	26.25	25	8.75
	40	75	30	25	10

Table (5) : Summery of Coagulants Dosages of (Alum and Alum + Silica).

Set No.	Dosage of coagulant mg/l	Percentage of alum %	Dosage of alum mg/l	Percentage of Silica %	Dosage of Silica mg/l
1	15	100	15	0	0
	20	100	20	0	0
	25	100	25	0	0
	30	100	30	0	0
	35	100	35	0	0
	40	100	40	0	5
2	15	50	7.5	50	7.5
	20	50	10	50	10
	25	50	12.5	50	12.5
	30	50	15	50	15
	35	50	17.5	50	17.5
	40	50	20	50	20
3	15	60	9	40	6
	20	60	12	40	8
	25	60	15	40	10
	30	60	18	40	12
	35	60	21	40	14
	40	60	24	40	16
4	15	75	11.25	25	3.75
	20	75	15	25	5
	25	75	18.75	25	6.25
	30	75	22.5	25	7.5
	35	75	26.25	25	8.75
	40	75	30	25	10

Table (6) : Results of Coagulant Aid of Silica and Porcelanite (Residual Turbidity, PH, E, Salt and TDS) Values.

Coagulant Type	Coagulant Dosage mg/l	Dosage Percentage %	Residual Turbidity NTU	Turbidity Removal %	pH	E.C µ.s/cm	Salt	TDS mg/l
Porcelanite	15	100	84.3	81.26	7.9	1050	0.3	560
	20	100	48.4	89.24	7.87	1018	0.3	565
	25	100	36	92	7.81	1026	0.3	545
	30	100	47.3	89.48	7.79	1029	0.3	566
	35	100	65	85.55	7.82	1046	0.3	650
	40	100	90.3	79.93	7.88	1044	0.3	550
Silica	15	100	107.7	76	7.66	1272	0.6	646
	20	100	90.2	79.95	7.77	1271	0.6	649
	25	100	93.3	79.26	7.78	1275	0.6	651
	30	100	93.8	79.15	7.64	1277	0.6	652
	35	100	101.2	77.51	7.65	1275	0.6	652
	40	100	85.5	81	7.79	1268	0.6	653
	115	100	179	60.22	8.44	1286	0.7	677
	170	100	113	74.88	8.89	1289	0.7	676
	225	100	130	71.11	8.86	1278	0.7	669
	280	100	117	74	8.9	1286	0.7	674
	335	100	125	72.22	9	1291	0.7	679
	390	100	148	67.11	9.05	1290	0.7	684

Table (7): Results of Coagulant Aid of Porcelanite (Residual Turbidity, PH, E.C, Salt and TDS Values).

Set No.	Dosage of coagulant mg/l	Percentage of alum %	Residual Turbidity NTU	Turbidity Removal %	pH	E.C µ.s/cm	salt	TDS mg/l
1	15	100	36.9	91.8	7.78	1030	0.4	534
	20	100	25.74	94.28	7.74	1030	0.4	540
	25	100	10.53	97.66	7.61	1035	0.4	522
	30	100	12.4	97.24	7.56	1033	0.4	533
	35	100	11.43	97.46	7.43	1034	0.4	523
	40	100	13.3	97	7.38	1036	0.4	531
2	15	50	25.67	94.29	7.76	1064	0.3	534
	20	50	24.45	94.56	7.72	1064	0.3	539
	25	50	24.12	94.64	7.69	1066	0.4	542
	30	50	24.38	94.58	7.64	1068	0.4	543
	35	50	26.1	94.2	7.61	1067	0.4	543
	40	50	26.78	94	7.57	1069	0.4	544
3	15	60	26.4	94.13	7.71	1236	0.6	611
	20	60	19.2	95.73	7.65	1238	0.6	612
	25	60	19.85	95.58	7.62	1235	0.6	620
	30	60	15.4	96.57	7.58	1248	0.6	616
	35	60	10.41	97.68	7.52	1240	0.6	615
	40	60	23.34	94.81	7.49	1231	0.6	614
4	15	75	16.45	96.34	7.73	1164	0.6	588
	20	75	18.6	95.86	7.65	1300	0.6	658
	25	75	10.51	97.66	7.55	1300	0.6	658
	30	75	7.51	98.33	7.45	1301	0.6	659
	35	75	9.21	97.95	7.42	1299	0.6	658
	40	75	9.53	97.88	7.45	1299	0.6	660

Table (8): Results of Coagulant Aid of Silica gel (Residual Turbidity, PH, E, Salt and TDS Values).

Set No.	Dosage of coagulant mg/l	Percentage of alum %	Residual Turbidity NTU	Turbidity Removal %	pH	E.C µ.s/cm	Salt	TDS mg/l
1	15	100	36.9	91.8	7.78	1030	0.4	534
	20	100	25.74	94.28	7.74	1030	0.4	540
	25	100	10.53	97.66	7.61	1035	0.4	522
	30	100	12.4	97.24	7.56	1033	0.4	533
	35	100	11.43	97.46	7.43	1034	0.4	523
	40	100	13.3	97	7.38	1036	0.4	531
2	15	50	16.4	96.35	7.47	1181	0.6	596
	20	50	14.4	96.8	7.48	1188	0.6	598
	25	50	12.6	97.2	7.45	1195	0.6	598
	30	50	10.01	97.77	7.44	1199	0.6	600
	35	50	14.8	96.71	7.44	1200	0.6	603
	40	50	13.56	96.98	7.42	1200	0.6	606
3	15	60	8.71	98	7.68	1157	0.6	595
	20	60	5.68	98.73	7.61	1175	0.6	601
	25	60	5.74	98.72	7.6	1180	0.6	602
	30	60	4.56	98.98	7.66	1184	0.6	603
	35	60	6.33	98.59	7.69	1184	0.6	604
	40	60	6	98.66	7.91	1185	0.6	605
4	15	75	7.27	98.38	7.54	1105	0.5	564
	20	75	6.37	98.58	7.64	1111	0.5	566
	25	75	10.6	97.64	7.88	1106	0.5	561
	30	75	8.45	98.12	8	1108	0.5	561
	35	75	5.01	98.88	7.7	1125	0.5	570
	40	75	5.41	98.79	7.65	1130	0.6	574

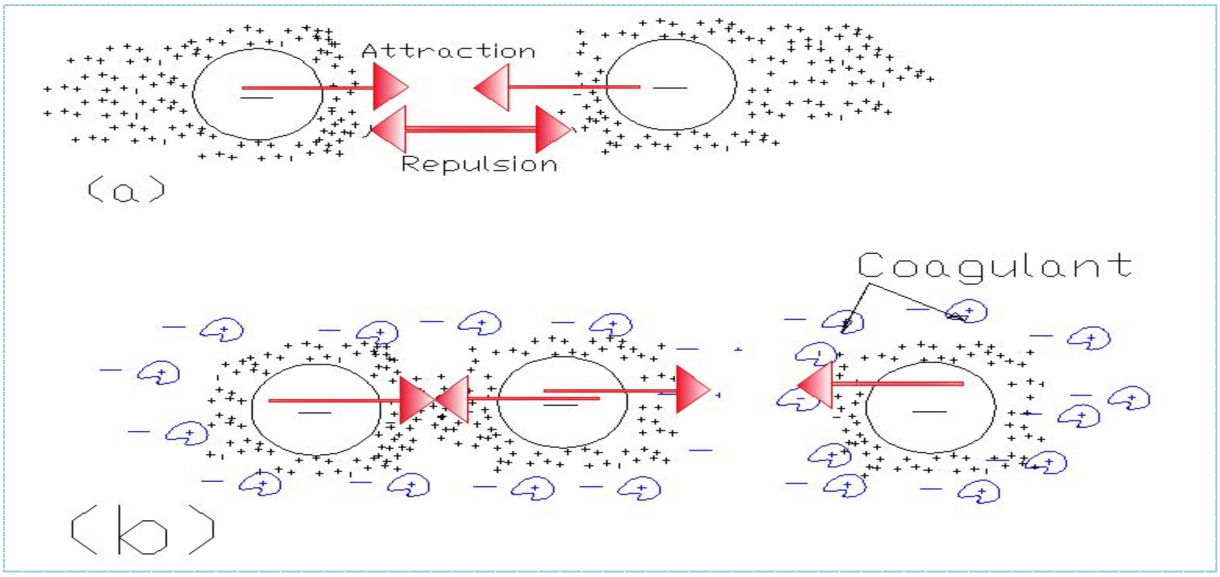

Figure (A): Schematic of Colloids and Coagulation:(a) Forces Acting on Hydrophobic Colloids,(b) Compression of The Double- Layer on Colloids(Destabilization) By Addition of Chemical Coagulants[3].

Photo (1): Jar Tester.

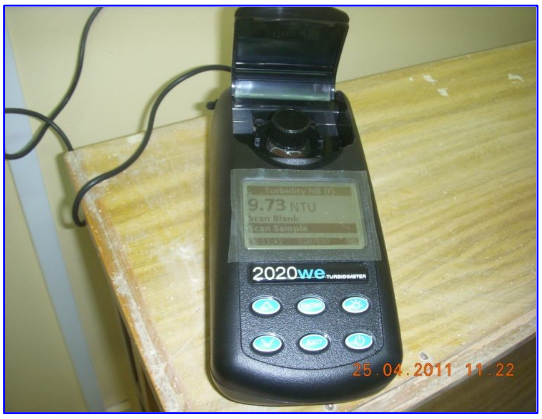

Photo (2) : Turbidity Meter.

Photo (3) : balance 210gm.

Photo (4) : TDS, E.C and Salt Meter

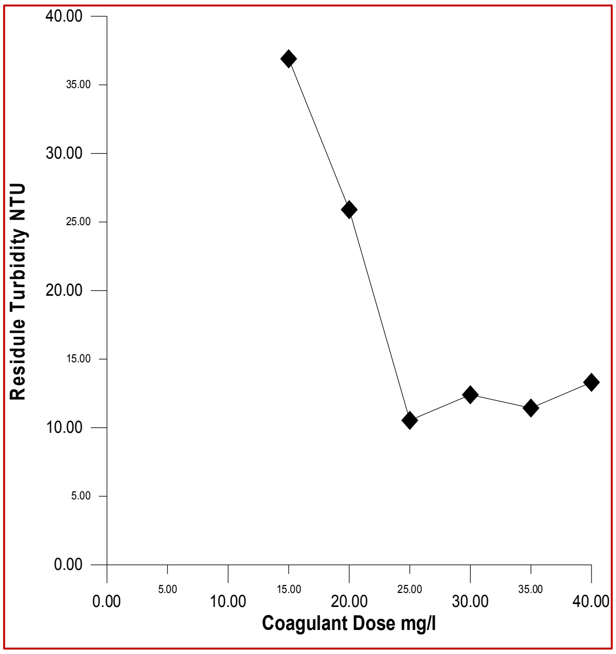

Figure (1): Residual Turbidity Vs Coagulant (Alum 100%).

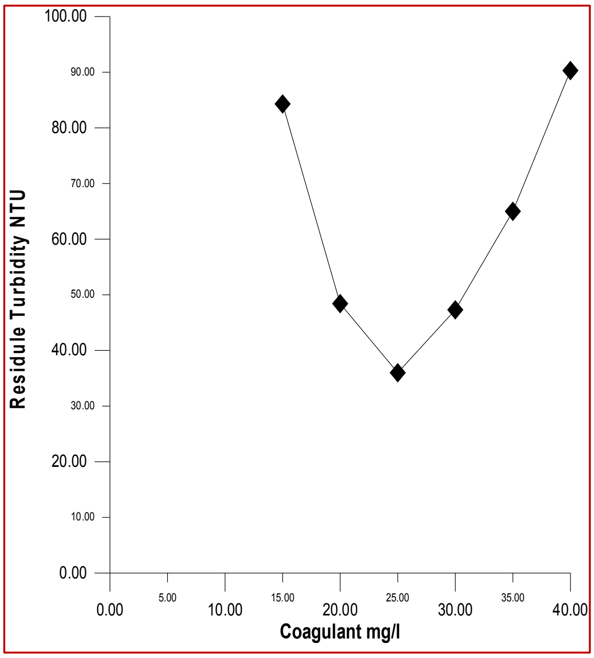

Figure (2): Residual Turbidity Vs Coagulant (Porcelanite 100%).

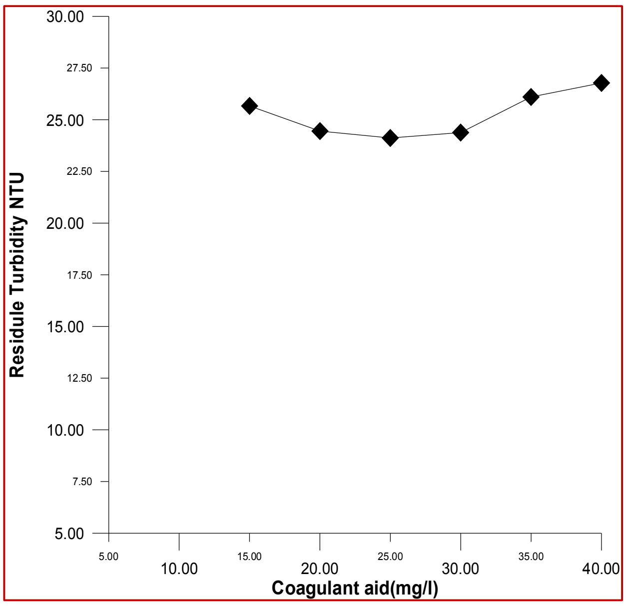

Figure (3): Residual Turbidity Vs Coagulant Aid (Alum 50%).

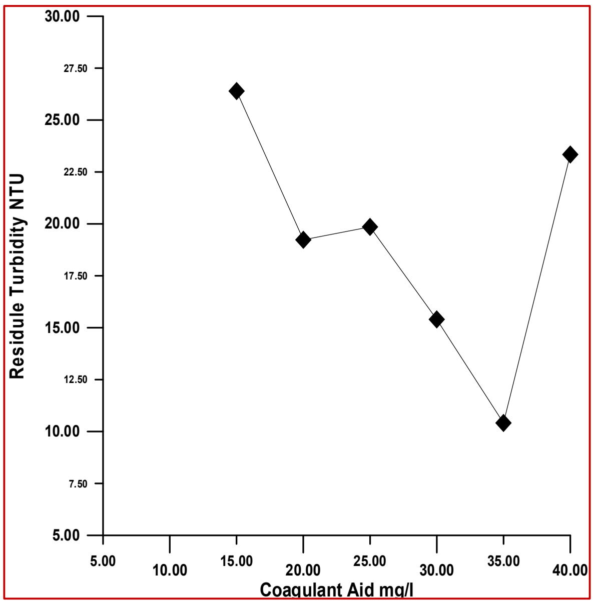

Figure (4): Residual Turbidity Vs Coagulant Aid (Alum 60%).

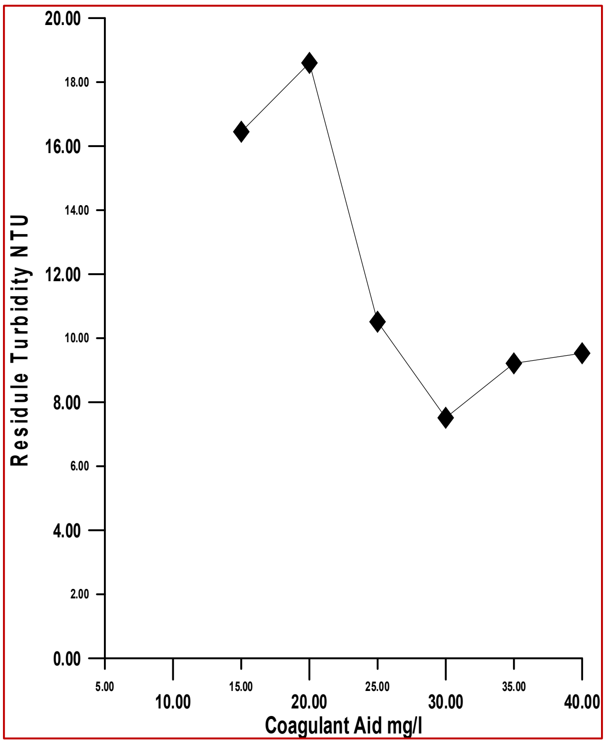

Figure (5): Residual Turbidity Vs Coagulant Aid (Alum 75%).

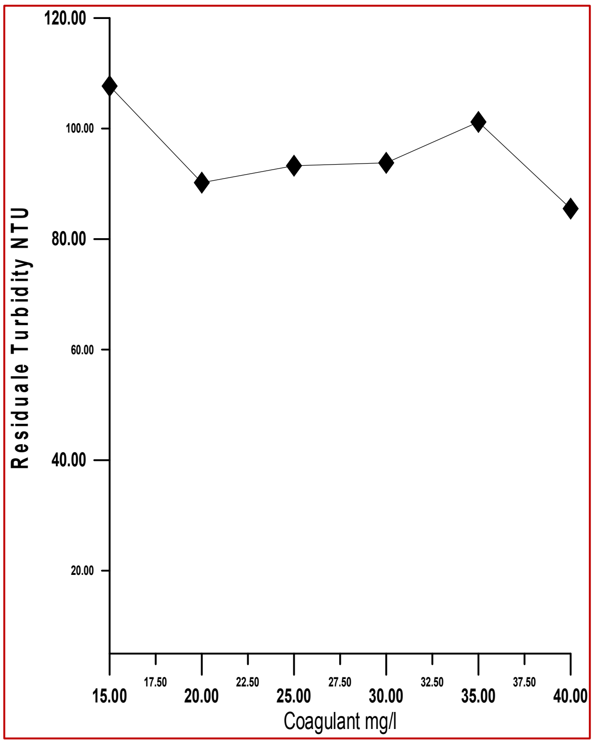

Figure (6): Residual Turbidity Vs Coagulant (Silica 100%).

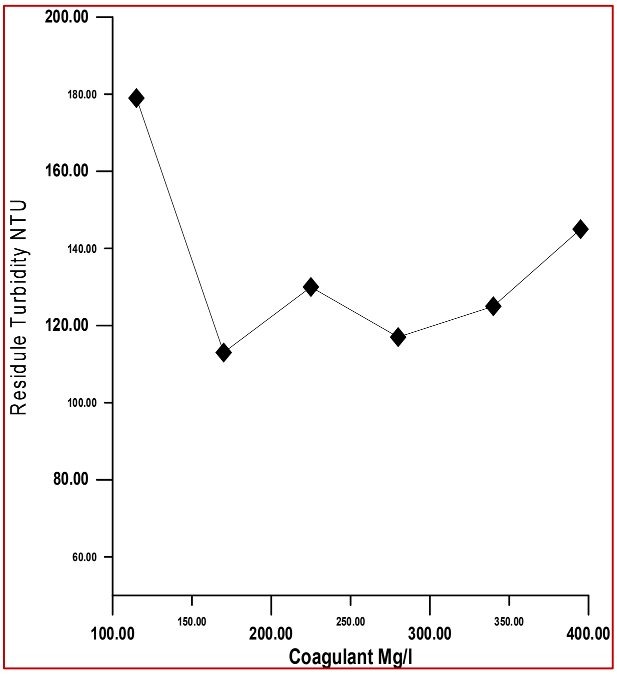

Figure (7): Residual Turbidity Vs Coagulant (Silica 100%).

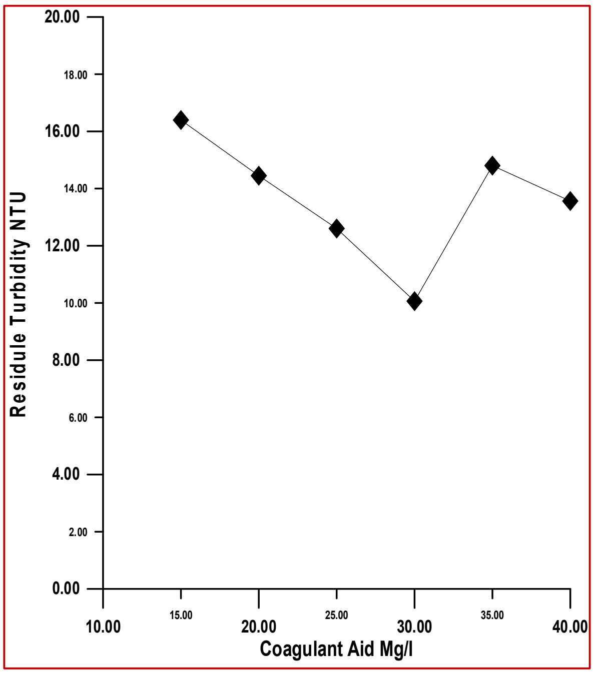

Figure (7): Residual Turbidity Vs Coagulant Aid Silica (Alum 50%).

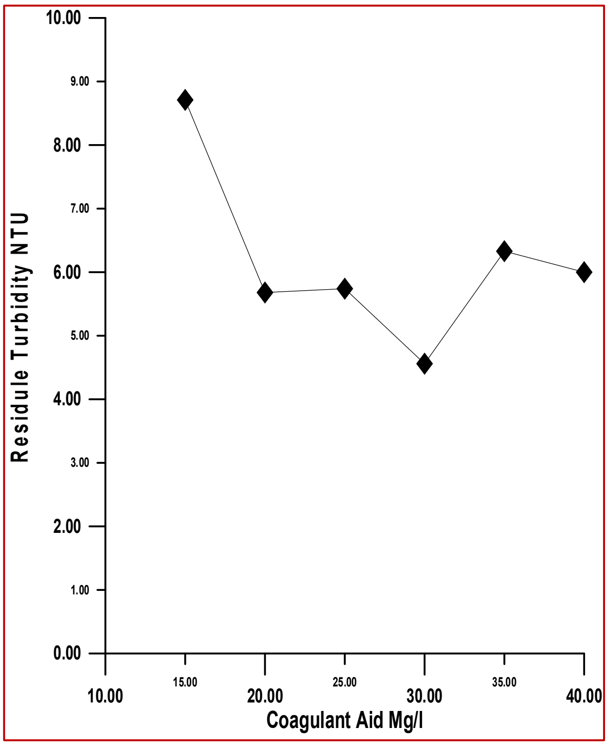

Figure (9): Residual Turbidity Vs Coagulant Aid Silica (Alum 60%).

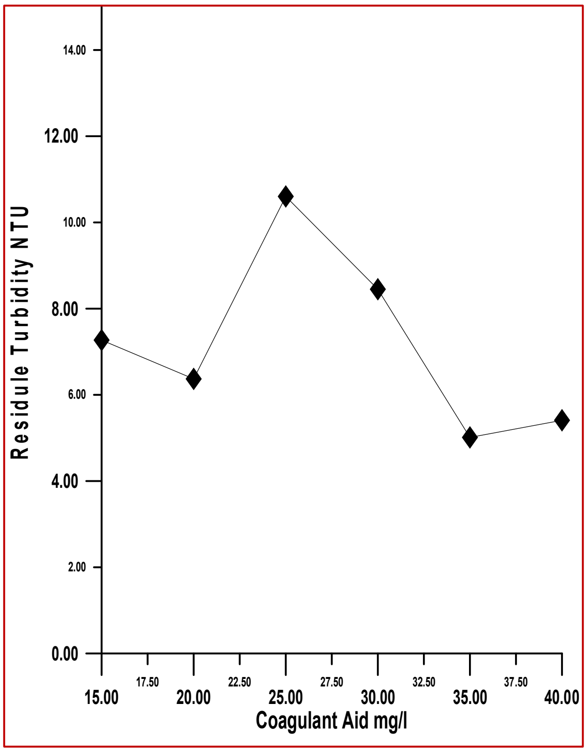

Figure (10): Residual Turbidity Vs Coagulant Aid Silica (Alum 75%).

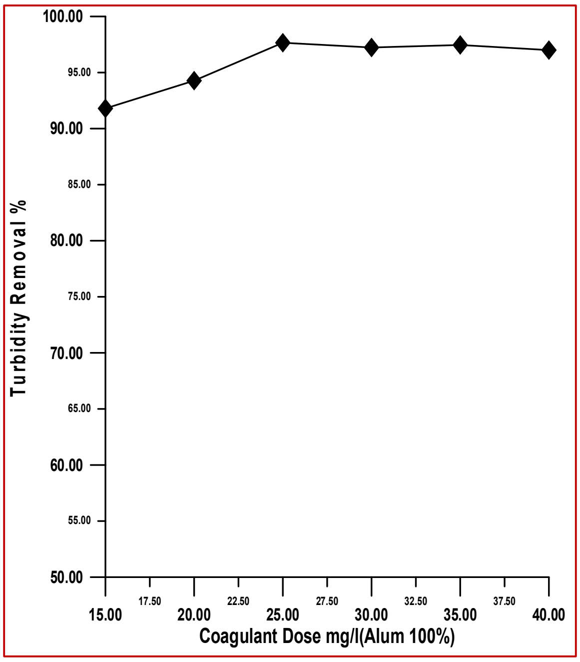

Figure (11): Coagulant Dose (Alum 100%) Vs Turbidity Removal %.

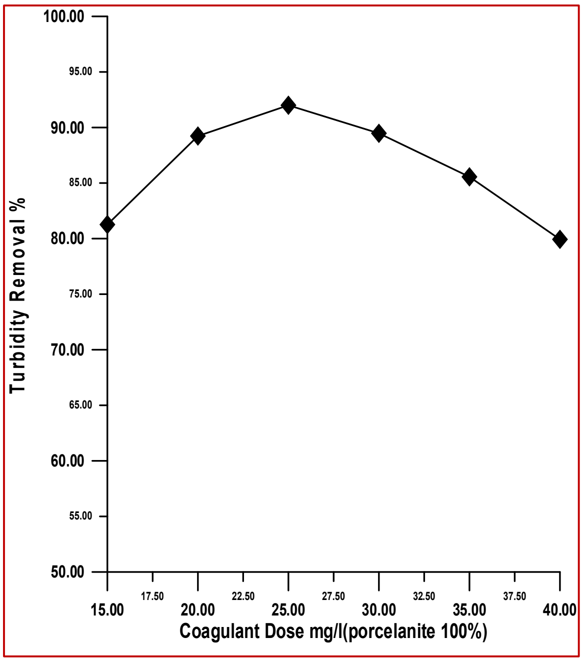

Figure (12): Coagulant Aid Dose Vs Turbidity Removal %.

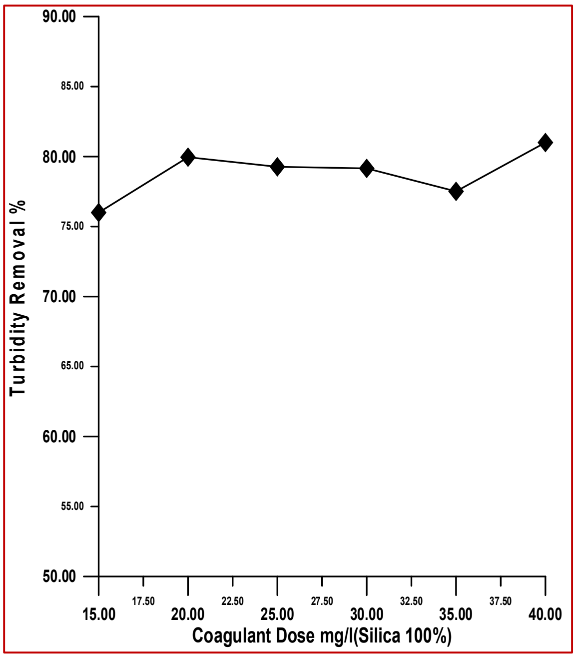

Figure (13): Coagulant Dose (Silica 100%) Vs Turbidity Removal %.

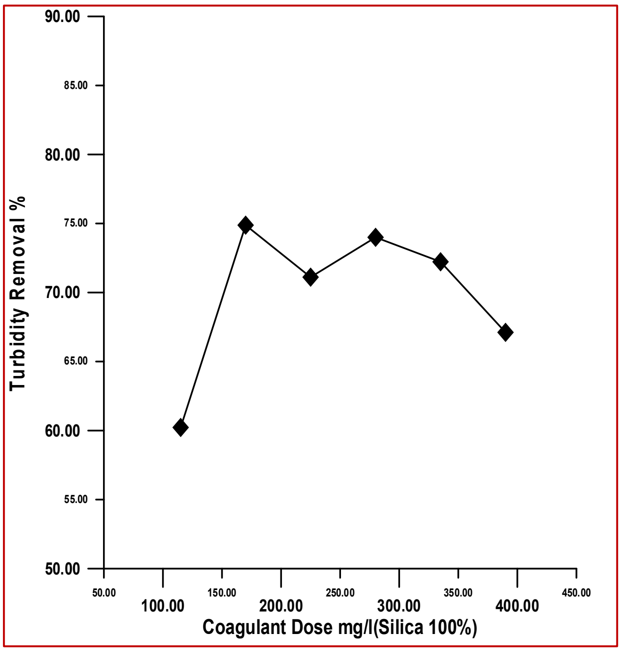

Figure (14): Coagulant Dose (Silica 100%) Vs Turbidity Removal %.

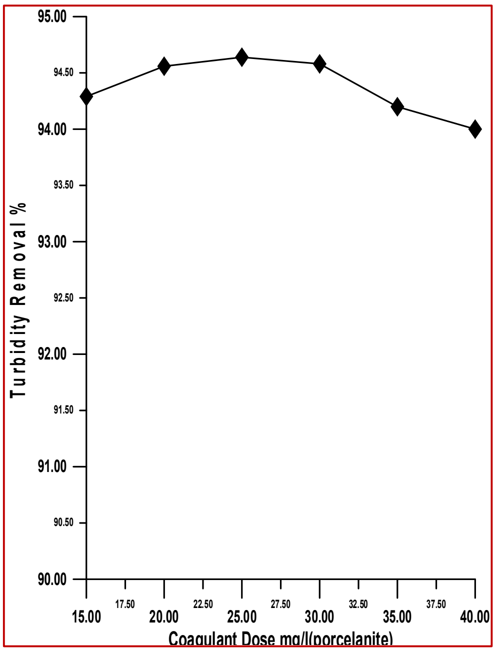

Figure (15): Coagulant Dose Vs Turbidity Removal %(Alum 50%).

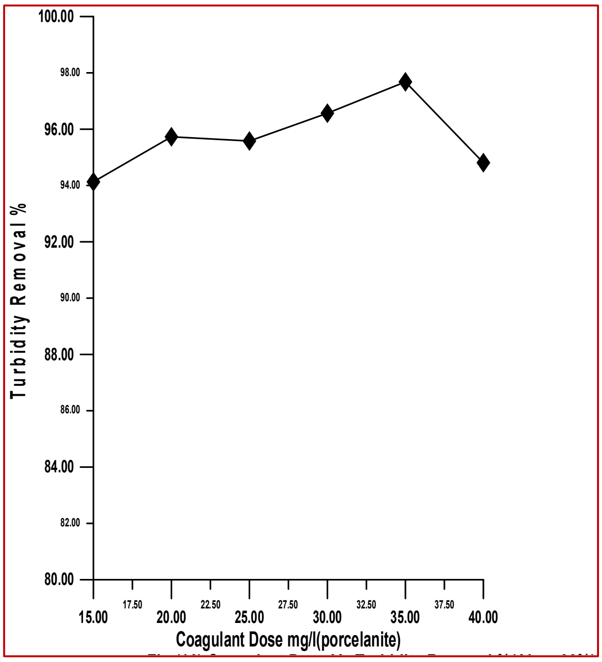

Figure (16): Coagulant Dose Vs Turbidity Removal %(Alum 60%).

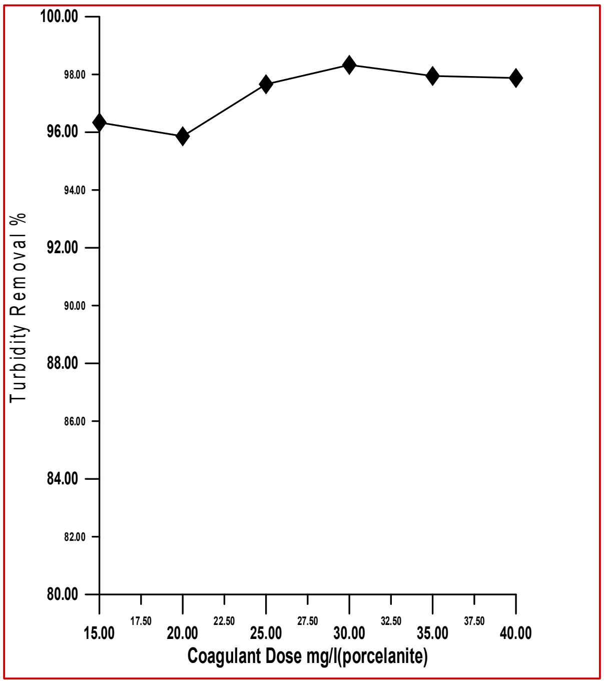

Figure (17): Coagulant Dose Vs Turbidity Removal % (Alum 75%).

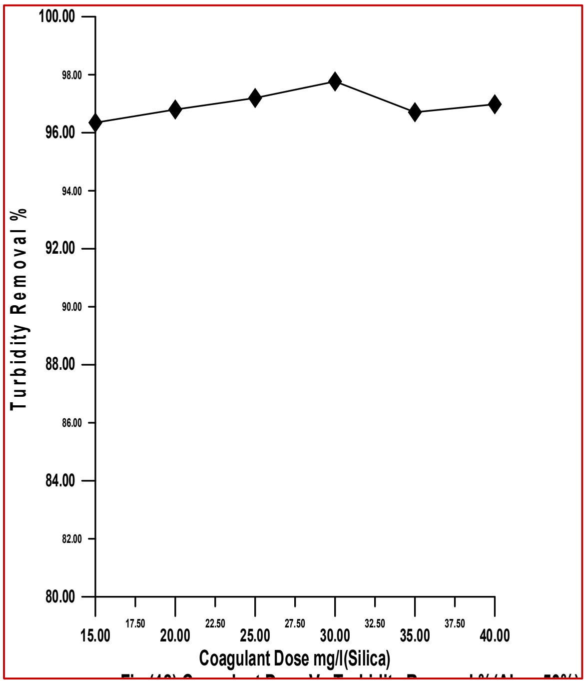

Figure (18): Coagulant Dose Vs Turbidity Removal %(Alum 50%).

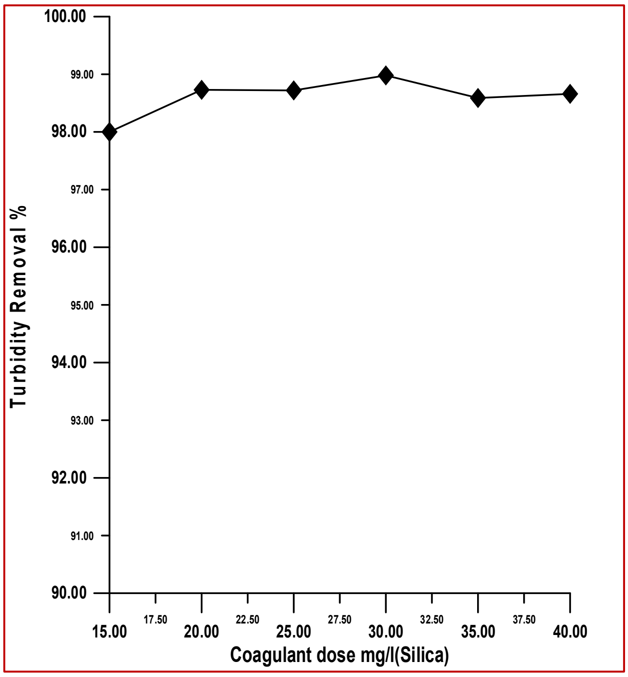

Figure (19): Coagulant Dose Vs Turbidity Removal %(Alum 60%).

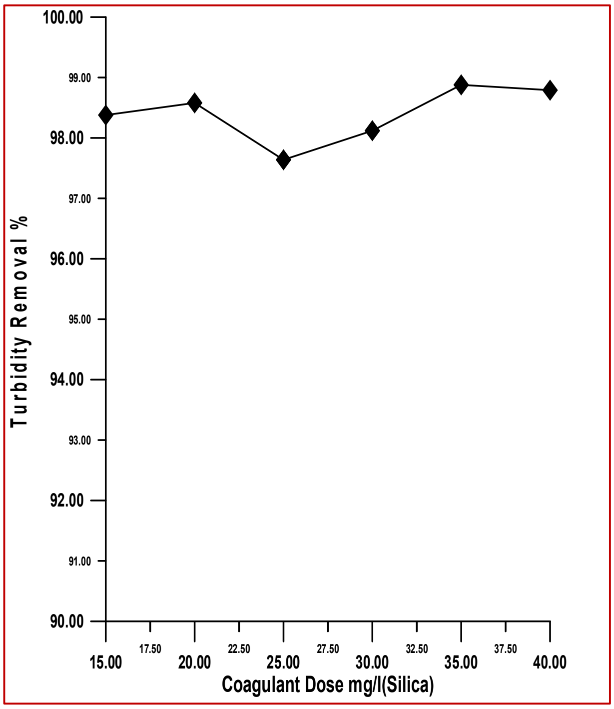

Figure (20): Coagulant Dose Vs Turbidity Removal %(Alum 75%).

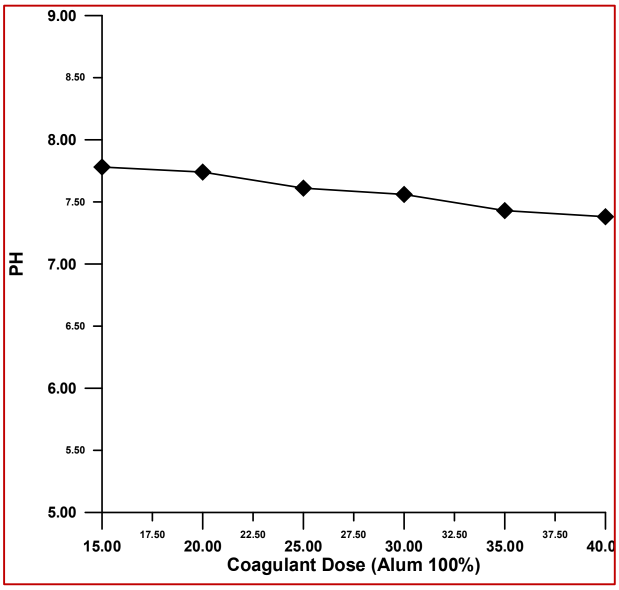

Figure (21): Coagulant Dose Vs pH.

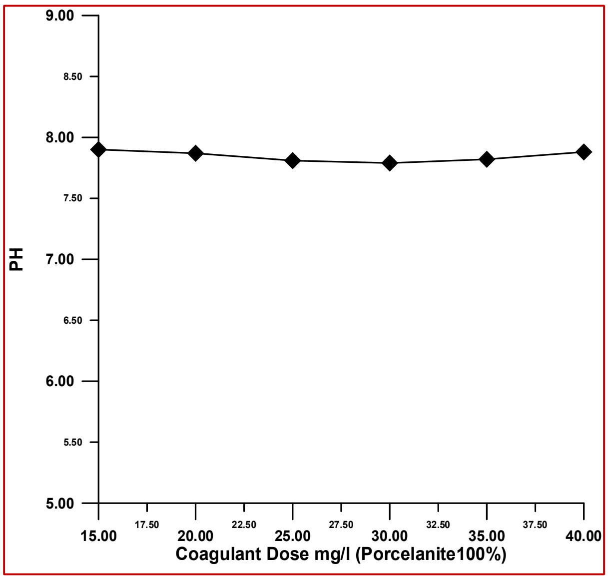

Figure (22): Coagulant Dose Vs pH.

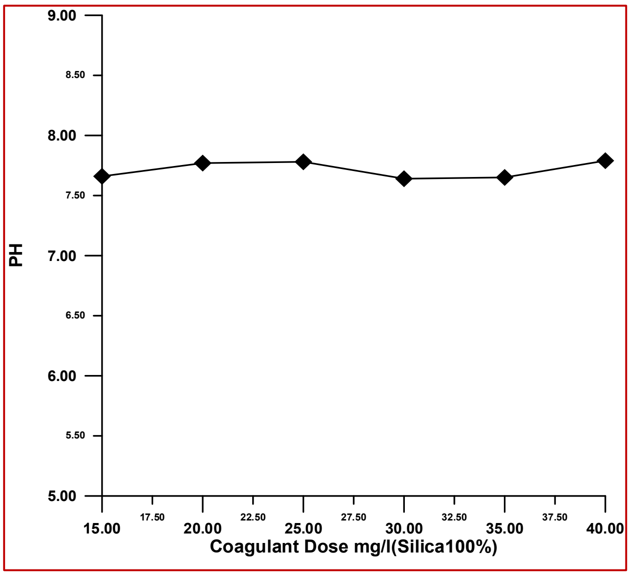

Figure (23): Coagulant Dose Vs pH.

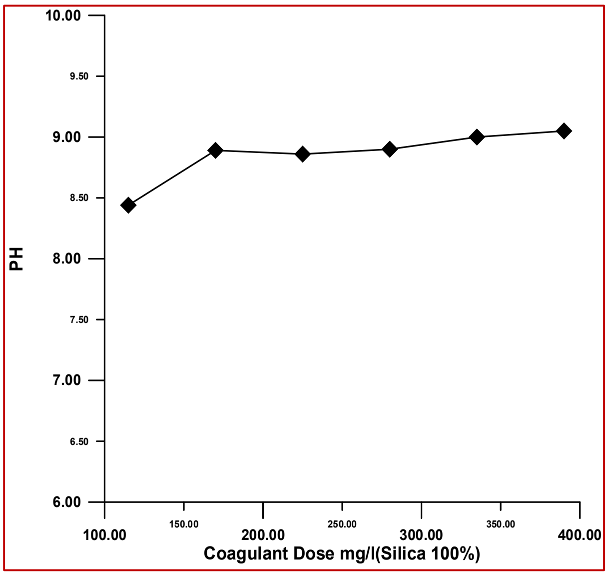

Figure (24): Coagulant Dose Vs pH.

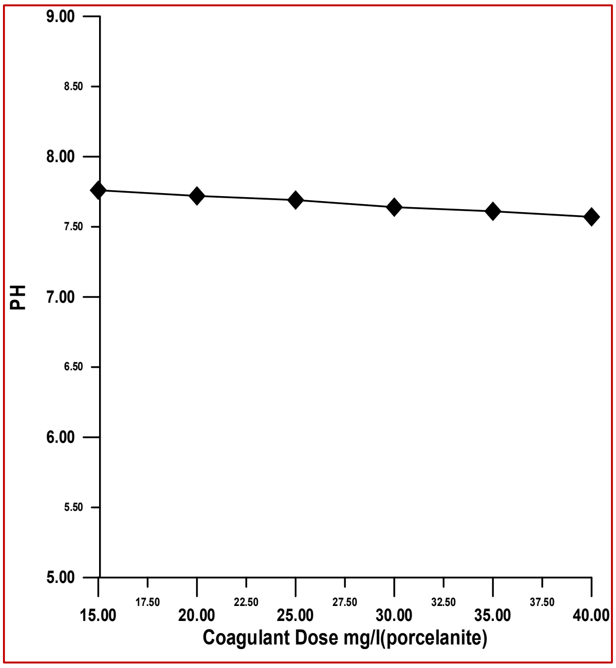

Figure (25): Coagulant Dose Vs pH (Alum 50%).

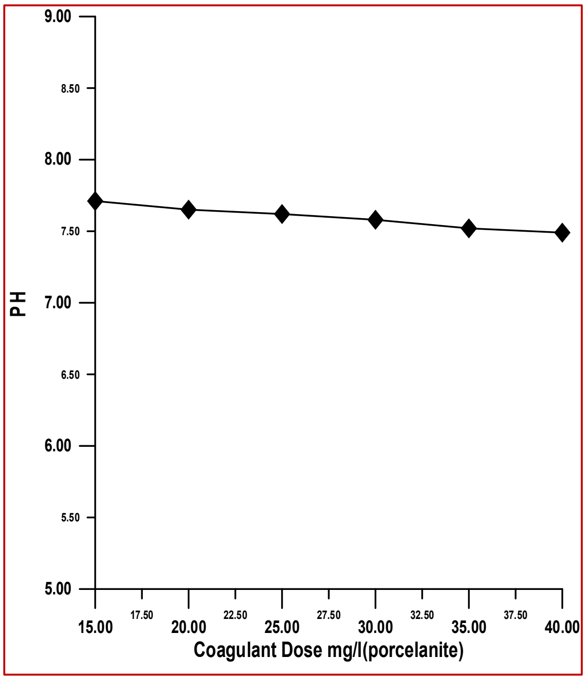

Figure (26): Coagulant Dose Vs pH (Alum 60%)

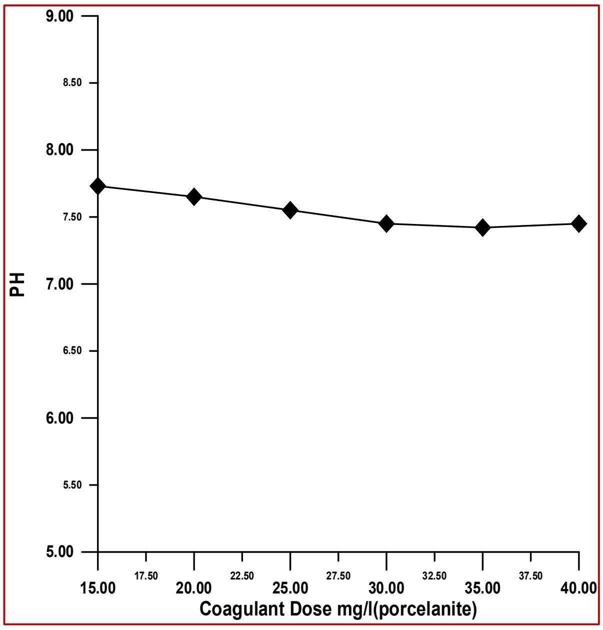

Figure (27): Coagulant Dose Vs pH (Alum 75%)

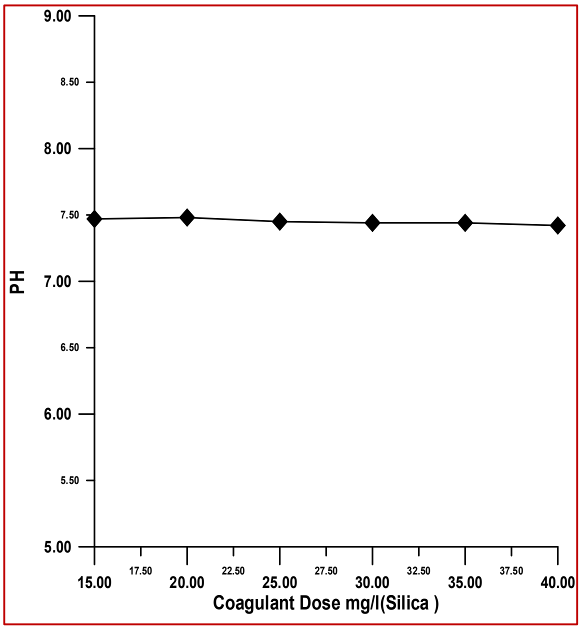

Figure (28): Coagulant Dose Vs pH (Alum 50%).

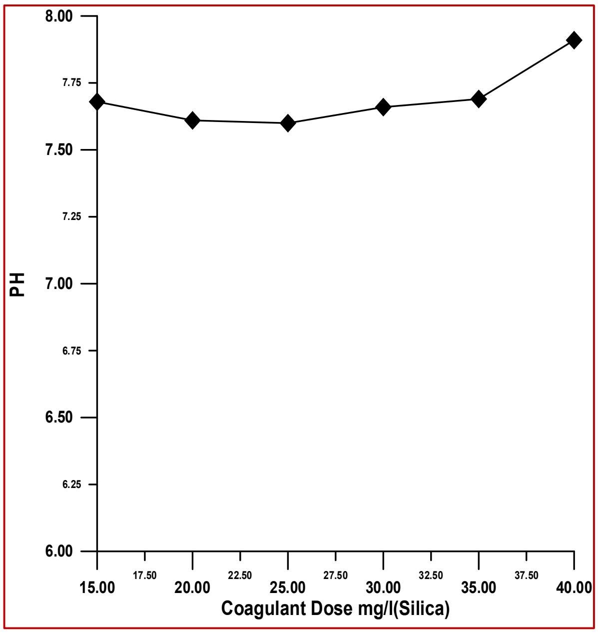

Figure (29): Coagulant Dose Vs pH (Alum 60%).

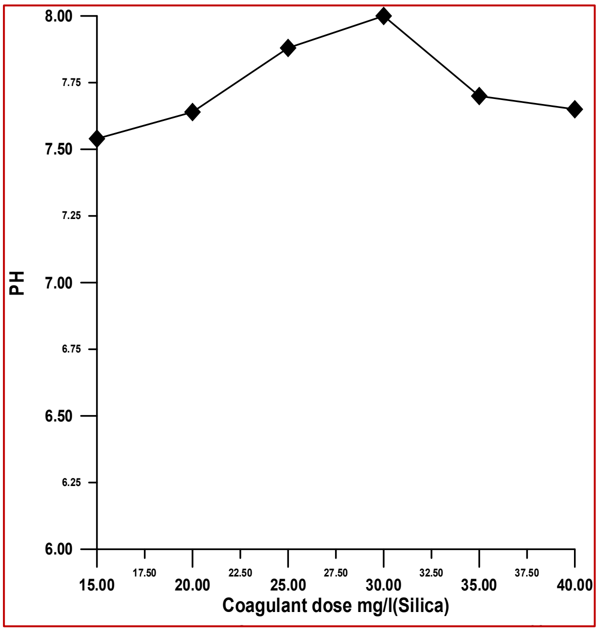

Figure (30): Coagulant Dose Vs pH (Alum 75%).

-

تأثير استخدام المخثرات والمخثرات المساعدة (بورسيليناين وجل السليكا) على تحسين معالجه مياه الشرب ذات الكدره العالية

م.م. أركان ضاري جلال
قسم هندسة السدود والموارد المائية
كليه الهندسة- جامعه الانبار

الخلاصـة.

أجريت الكثير من الدراسات والبحوث لغرض تحسين كفاءة معالجه المياه من خلال ازاله الكدره العاليه باستخدام مخثرات مختلفة مثل الشب والمخثرات المساعده مثل البوليمرات العضويه وغير العضويه.وكثير من هذه البحوث وعلى مر السنيين أوضحت تأثير استخدام هذه البوليمرات كمخثرات مساعده لأزاله الكدره العاليه للمياه وتحسين عمليه التخثير والتلبيد وبالتالي تحسين نوعيه المياه.

أجريت في هذا البحث عده تجارب لدراسه تأثير استخدام أنواع أخرى مختلفه من المخثرات المساعدة غير البوليمرات على كفاءه الازاله للكدره وحساب افضل جرعه المخثر (الشب) والمخثر المساعد.المخثرات المستخدمة في هذه الدراسة هي البورسلينايت وجل السليكا المستعمل في الشركه العامه لصناعه الزجاج والسيراميك في مدينه الرمادي في الحاله السائله أضافه إلى المخثر الرئيسي الشب . الكدره الابتدائية المصنعه المستخدمه في الدراسه كانت 450 NTU والتي تم تكوينها باستخدام طين الكاؤولين بحجم حبيبي 10μm .

لقد تم استخدام هذه المخثران المساعده مع الشب بنسب مختلفه وهي 0 ,50%,60%,75% وملاحظه تاثير كل نسبه من هذه المخثرات والمقارنه بين هذه المخثرات واختيار المخثر والنسبه التي تعطي اقضل نسبه ازاله.النتائج التي تم الحصول عليها هي الكدره المتبقيه وتم رسم العلاقه بينها وبين نسبه المخثر المضافه وملاحظه تاثير هذه النسبه على كفاءه الازاله اضافه الى ذلك تم حساب المعاملات التاليه pH,TDS,E.C, Salt، والتي تمثل الملوحه ،الايصاليه،الاملاح الذائبه والرقم الهيدروجيني على التوالي .النتائج التي تم الحصول عليها بينت ان الجرعه الافضل30 mg/l التي اعطت اقضل نسبه ازاله 98.98% وكدره متبقيه بمقدار 4.56 NTU كانت باستخدام جل السليكا بنسبه 60% وجرعه شب تساوي 40% و الرقم الهيدروجيني (pH) يساوي 7.66 .

الكلمات الرئيسية: مياه،تخثير،العكورة،معالجة،إزالة.