

**Analysis of water quality using physico-chemical parameters and coagulation treatment to water of Kolavada Lake using PAC, natural coagulant and mixture of coagulants**

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## Abstract

The present study deals with the physico-chemical parameters and effect of plant based coagulant, chemical coagulant and mixture of coagulants on water of Kolavada Lake, District Gandhinagar, Gujarat. Changes in physical and chemical parameters such as water temperature, transparency, turbidity, total dissolved solids, pH, dissolved oxygen, BOD, COD and total hardness, chlorides, alkalinity, phosphate and nitrates were analyzed. Changes observed in all parameters after coagulants treatment. But all parameters were not within the permissible limits. The results indicate that the water of lake may be used for Irrigation.

**Keywords** *Physico-chemical analysis, Turbidity, Natural coagulant, water treatment, Kolavada Lake.*

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## INTRODUCTION

The present study is based on the analysis of water samples collected from Kolavada Lake, a region of Gandhinagar, Gujarat. The term “water quality” includes the water column and the physical channel required to sustain aquatic life. Water is a basic human need and a major requirement of any society. Waterborne diseases are a feature of developing countries whose populace is compelled to use turbid and contaminated water for domestic purposes. The removal of colloidal and suspended particles present in water would be extremely beneficial as it would assuage the majority of problems associated with turbidity. Most particulate matter cannot settle by gravity and their sizes are so small that they pass through the pores of most common filtration media <sup>[1]</sup>. Conventionally, removal of the colloids in

water could be achieved by coagulation, using certain chemical coagulants like certified aluminium salts, iron salts, polyelectrolytes etc. Recent studies have pointed out the health threats arising from the consumption of residual aluminium present in water, such as Alzheimers diseases and neurodegenerative illness <sup>[2]</sup>. So, many researchers have investigated the potential of natural coagulants <sup>[3]</sup>. These coagulants are very effective as a primary coagulant in water treatment and are comparable to conventional chemical coagulants. <sup>[4,5]</sup> Producing potable water from surface water or ground water usually involves one or several treatment steps for removing unwanted substances <sup>[6]</sup>. All natural lakes ecosystem are self regulated and balanced <sup>[7]</sup>. The biological

components of fresh water depend solely on physico-chemical conditions. Analysis of physical and chemical parameters of water is therefore essential [8]. Coagulation–flocculation is one of the most important physicochemical treatment steps in industrial wastewater treatment [9,10].

The aim of the present study is to evaluate and compare the effectiveness of natural coagulants, poly aluminum chloride (PAC) as coagulant and its synergistic effect on various physicochemical parameters of lake water taken for the study.

## EXPERIMENTAL

Synthetic chemical coagulant poly aluminium chloride (PAC), *Citrus lemonum* (lemon) juice and its various combinations were used for this study. PAC and *Citrus lemonum* (lemon) juice are water soluble; therefore, solutions of required concentrations of these coagulants are prepared in distilled water.

Water sample collected for the study are at two different time intervals, in rainy season (July-2013 to Dec-2013) and in summer (Jan-2014 to June-2014). The sample analyzed for various water quality parameters as per standard procedures given in APHA Standard Methods 1992. Standard Jar test apparatus of 1.0L capacity were used

**TABLE 1 Below table is July- 2013 to Dec- 2013: [Citrus lemonum(Lemon)]**

for the coagulation and sedimentation study. Turbidity of the samples were measured by turbidity meter (Digital turbidity meter-234). Raw samples, chemically precipitated samples and aerated samples have been taken for the measurement of turbidity and COD. COD was measured using DBK (DBK-COD Digestor) instrument). Various parameters such as pH, conductivity, total alkalinity, calcium hardness, magnesium hardness, total hardness, total dissolved solids, chloride, sulphate, phosphate, nitrate, nitrite, fluoride, DO, BOD, COD, and turbidity were measured initially and after 24 hours of the addition of coagulants of desired concentrations taken for the study. The results obtained are noted to reach the conclusion.

## RESULT AND DISCUSSION

**Table 1:** Show results of village: kolavada. From July-2013 to Dec-2013 (Before &after treatment)

**Table 2:** Show results of village: kolavada. From Jan-2014 to June-2014(Before &after treatment)

Village	PH	EC	Alkalinity	Ca-hard	Mg-hard	TH	TDS	Sulphate	Fluoride	Phosphate	Nitrate	Nitrite	DO	COD	BOD	Chloride	IN Terbidi	24-Terbidi
Kolavada	8.42	1.04	859.5	38.48	3.89	112	1127	576.39	.033	0.09	0.5	Nd	4.8	305	80	159.04	148	55

Village	Coagulant	ppm	Clear Zone	Turbidity	PH	EC	Alkalinity	Ca-hard	Mg-hard	TH	TDS	Sulphate	fluoride	Phosphate	Nitrate	Nitrite	DO	COD	BOD	Chloride
Kolavada	PAC	10	89	7.0	8.44	0.95	729.2	28.85	1.95	80	59	192.13	0.33	0.028	0.383	Nd	5.7	75	37	149.1
		20	95	6.0	8.44	0.95	727.5	28.85	1.95	80	59	192.13	0.33	0.028	0.383	Nd	5.7	73	37	151.94
		30	95	5.0	8.42	0.96	726.5	28.85	1.95	80	59	192.13	0.33	0.028	0.383	Nd	5.4	68	34	151.94
		40	95	3.0	8.42	0.96	726	27.75	2.91	80	59	288.2	0.33	0.02	0.383	Nd	5.6	71.5	33	151.94
		50	95	1.0	8.42	0.97	725	27.75	2.91	80	59	288.2	0.33	0.028	0.383	Nd	5.7	56	27	153.36
	Lemon	10	95	4.0	8.45	0.94	724.5	28.85	1.95	80	59	192.13	0.33	0.028	0.383	Nd	5.9	57	27	147.68
		20	95	4.0	8.44	0.94	724.5	28.85	1.95	80	60	192.13	0.33	0.028	0.383	Nd	5.9	52	25	146.26
		30	95	4.0	8.44	0.95	723.5	28.85	2.91	84	60	96.01	0.33	0.036	0.383	Nd	5.7	54	23	146.26
		40	95	4.0	8.44	0.96	723	30.45	1.95	84	60	96.01	0.33	0.036	0.5	Nd	6	44.3	20	144.84
		50	95	4.0	8.43	0.96	722	30.45	1.95	84	60	96.01	0.33	0.036	0.383	Nd	4.9	87	41	144.84
	PAC+Lemon	10+10	94	5.0	8.38	0.99	726.5	30.45	0.97	80	59	384.26	0.33	0.028	0.383	Nd	5	75	38	146.26
		10+20	94	5.0	8.38	0.95	726	30.45	0.97	80	59	288.2	0.33	0.028	0.383	Nd	5	78	39	146.26
		10+30	94	5.0	8.36	0.96	724	28.85	1.95	80	59	288.2	0.33	0.028	0.5	Nd	4.9	79.5	37	149.1
		10+40	94	5.0	8.36	0.96	724.5	28.85	1.95	80	60	192.13	0.33	0.08	0.383	Nd	4.9	80.2	37	149.1
		10+50	94	5.0	8.35	0.98	722	30.45	0.97	80	59	192.13	0.33	0.02	0.383	Nd	5	84	39	149.1

**Air and water temperature:** The maximum and minimum ambient temperature of Kolavada Lake ranges from 23.43<sup>0</sup>C to 36.85<sup>0</sup>C and the water temperature varied from 21.75<sup>0</sup>C to 36.23<sup>0</sup>C. The highest temperature was noticed during the summer and lowest was during the winter.

**Transparency:** Suspended materials in water produce turbidity and reduce light penetration. Transparency is inversely proportional to the turbidity of water. In the

present study, transparency was recorded to be maximum during winter and summer which was equal to depth of water. The water was observed minimum transparent in the monsoon season.

The analysis of the water quality parameters of Kolavada Lake, District Gandhinagar, Gujarat shows that pH, Temperature, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Alkalinity, Acidity, Total Hardness, Chloride and Phosphorus values are not within the permissible limits

TABLE 2 Januay- 2014 to June- 2014

Village	P H	E C	Alkalinity	Ca-hard	Mg-hard	T H	TD S	Sulphate	Fluoride	Phosphate	Nitrate	Nitrite	D O	CO D	BO D	Chloride	IN Terbidi	24- Terbidi
Kolavda	8.48	1.1	584	24.05	16.54	128	1141	960.66	0.666	0.122	0	Nd	4	318	92	241.4	125	35

Village	Coagulant	ppm	Clear Zone	Turbidity	P H	E C	Alkalinity	Ca-hard	Mg-hard	T H	TD S	Sulphate	fluoride	Phosphate	Nitrate	Nitrite	D O	C O D	B O D	Chloride
Kolvda	PAC	10	85	6.0	8.38	0.98	485	19.24	11.67	96	584	576.4	0.333	0.098	0	Nd	4.3	68	42	215.8
		20	86	6.0	8.38	0.98	483	19.24	11.67	96	584	576.4	0.333	0.098	0	Nd	4.3	68	42	215.8
		30	89	4.0	8.39	0.98	483	19.24	11.67	96	584	576.4	0.333	0.098	0	Nd	4.3	64	40	215.8
		40	89	4.0	8.39	0.99	482	19.24	12.65	100	585	576.4	0.333	0.098	0	Nd	4.4	64	40	217.8
		50	92	2.0	8.39	0.99	482	20.84	12.65	100	585	672.5	0.333	0.098	0	Nd	4.4	65	39	217.8
	Lemon	10	87	5.0	8.40	0.92	492	20.84	12.65	100	579	480.33	0.333	0.098	0	Nd	4.2	64	35	208.7
		20	87	5.0	8.40	0.92	492	20.84	12.65	100	579	480.33	0.333	0.098	0	Nd	4.2	64	35	208.7
		30	89	4.0	8.40	0.92	490	20.84	12.65	100	579	480.33	0.333	0.098	0	Nd	4.2	63	35	208.7
		40	90	4.0	8.41	0.93	490	22.44	12.65	100	578	480.33	0.333	0.098	0	Nd	4.2	63	35	211.6
		50	92	2.0	8.41	0.93	488	22.44	12.65	100	580	576.4	0.333	0.104	0	Nd	4.3	67	37	204.5
	PAC+Lemon	10+10	86	5.0	8.36	0.95	487	22.44	10.70	100	590	576.4	0.333	0.104	0	Nd	4.3	70	48	204.5
		10+20	87	5.0	8.36	0.95	487	22.44	10.70	100	590	576.4	0.333	0.104	0	Nd	4.3	70	48	204.5
		10+30	88	4.0	8.36	0.95	486.5	20.84	10.70	100	590	576.4	0.333	0.104	0	Nd	4.3	72	48	207.8
		10+40	88	4.0	8.37	0.95	485	20.84	10.70	100	590	576.4	0.333	0.104	0	Nd	4.3	68	46	207.8
		10+50	90	3.0	8.37	0.96	485	20.84	11.67	100	592	672.5	0.333	0.114	0	Nd	4.4	68	46	210.7

Table shows that notable changes in pH, Electrical conductivity, Alkalinity, Ca<sup>+2</sup> hardness, Mg<sup>+2</sup> hardness, Total hardness, Total dissolve solids, Sulphate, Fluoride, Phosphate, Nitrate, Nitrite, Dissolve oxygen (D.O.), COD, BOD, Turbidity, and Chloride after coagulants treatment.

From the present study, it can be concluded that, the use of synthetic & natural coagulants like PAC, *Citrus lemonum* (lemon) and mixture of PAC & *Citrus lemonum* (lemon) are receiving attention for their effectiveness in water treatment.

## CONCLUSIONS

PAC and *Citrus lemonum* (lemon) showed better turbidity removal than that of the Alum and ferric chloride. The experiments conducted confirm the significant effect of coagulant dosage on coagulation process but above some data is

not in a permissible limit which is recognized by WHO. So this water is not useful for drinking purpose and other household purpose but May be it is useful in irrigation field.

## REFERENCES

- [1] Pretorius, W. A., Schutte, C.F. and Botha, J. (1996). Operation of Water Treatment Plants. Water Utilization Division, University on Pretoria.
- [2] Garcia-Fayos, B., Arnal, J. M., Verdú, G. and Sancho, M. (2010). Aquapot Project: Potential of Moringa Oleifera Seeds and its Application in Drinking Water Treatment. Institute for Industrial, Radiophysical and Environmental Safety (ISIRYM). Universidad.
- [3] Jahn, S. A. (1988). Using Moringa Seeds as Coagulants in Developing Countries. Journal of the America Water Works Association, 80 (6): 43 – 50.
- [4] R.A. Binayke & M. V. Jadhar, “Assessment of purification of water by using natural herbs.” Lokavishkar International E-journal.1 (IV) 2-22 (2012)
- [5] Md. Asrafuzzaman, A. N. M. Fakhruddin & M.D. A.Hossain “Reduction of turbidity of water using locally available natural coagulants” ISRN Microbiology, doi-10.5402/2011/632189, Article ID-632189(2011)
- [6] Bhoi D. K., Raj D. S., Mehta Y. M., Chauhan M. B. and Machhar M. T. ( 2005): Asian J. Chem, 17(1), 404-408.
- [7] Abbasi, S.A. 1997. Wetlands of India - Ecology and Threats; Discovery Publishing House, New Delhi, 127-148.
- [8] Salodia, P.K. (1996) Fresh Water Biology-An ecological approach; Surabhi Publications, Jaipur: 01-167.
- [9] Baisali Sarkar, P.P. Chakrabarti, A. Vijaykumar, Vijay Kale,(2006), — Wastewater treatment in dairy industries –possibility of reuse pp. 141-152,2006
- [10] G.Vijayaraghavan, T. Sivakumar, A. Vimal Kumar, (2011) —application of plant based coagulants for Waste water treatment , International Journal of Advanced Engineering Research and Studies Vol. I/ Issue I/October-December, 2011/88-92.

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