



“Treatment of Industrial Wastewater by Adsorption using Low Cost Adsorbents”

BY USING NATURAL CLAY AS ADSORBENT

¹Hardevsinh Chauhan,²Dr. Savan Tank

¹Student, M. Tech.,²Ass. Prof.

¹Environmental Engineering Department,

¹ Swarnim Startup & Innovation University, Gandhinagar, India

Abstract : The present research work focuses on Adsorption performance of Low-Cost Adsorbent Natural Clay. The adsorption of effluents on clay samples was examined. The samples of industrial wastewater were taken for this purpose including Chemical Manufacturing Industry, Textile Industries (Dyeing and Finishing), Dairy industry and Paper mill. Clay samples were taken from local areas of Gujarat, (Mostly from the area of Suredranagar). Chemical Analysis of all clay samples was taken to study their mineral composition. Effluent samples were treated with clay by shaking process. Different parameters of industrial effluents were analyzed and studied before and after the clay treatment and the difference between them was recorded. In the present study Natural Clay was used as Low Cost Adsorbent for the removal of pollutants & impurities from industrial wastewater samples collected from six different industries. After review & verifying data & results it was concluded that Natural Clay can be used as an efficient & effective Low Cost Adsorbent for the adsorption of contaminants in the industrial wastewater. The color of the industrial wastewater samples can be colorless or lightened after adsorption which clearly means the colored or visible pollutant or compounds are adsorbed on Natural Clay adsorbent. Other parameters like, pH, Conductivity, Total Dissolved Solids (TDS), Chloride Ions, Hardness, Acidity & COD were determined before & after clay treatment. The results revealed that the Natural Clay could be used as an Adsorbent for the treatment of industrial wastewater as it is very cheap and has no hazardous side-effects. It effectively removes the pollutant & contaminants from industrial effluent.

Key Words – Natural Clay as adsorbent, Adsorption, industrial wastewater.

I. INTRODUCTION

Industrial effluent causes a huge hazard to our environment and existence in totality. Finding a solution to this problem keeping in view industrial growth and its important in human civilization is the obstacle. The nature of the effluent is a sign that it is a complex process for reducing its hazardous nature and toxicity below prescribed limits. Various conventional techniques like Chemical Precipitation, Ion Exchange, Evaporation and Membrane Processes are in operation which provides various amount of treatment depending on the type & nature of wastewater and the pollutants present, and several unique and upcoming technologies like Photo-fenton Oxidation and Photosynthetic Bacteria Treatment has a very good potential to remove the toxic, hazardous and other harmful substances, Heavy Metals, Nitrogen, Phosphorous etc.

From all techniques and processes for treatment, adsorption is the most simple, powerful and most cost effective technique. The main advantage of this process is the wide range of adsorbents available and their fair cost in comparison to other chemicals and expensive methods.

During further study, we find that Activated Carbon is the most commonly used adsorbent among all adsorbents. Therefore a lot of study and work have been carried out using Activated Carbon. Researchers have found that other substances and another form of activated carbon like lignite, bentonite and other agricultural wastes also have good adsorption properties and are at simultaneously much cheaper than activated carbon.

Conventional Wastewater treatment:

Conventional wastewater/sewage treatment involves following stages in general, it may involve more stages also as per the nature of effluent stream and on the discharge characteristics required:

- Preliminary/Primary: The primary treatment is the first step where the Industrial wastewater flows through large tanks like pre-settling basins, primary sedimentation tank or primary clarifiers, here settleable solids like sand, dust, solid particles, grit, sludge etc. are sinks down, and lighter impurities like oil & grease etc. rise on the top and are skimmed off regularly using large scrapers.
- Advanced Primary: Enhanced removal of suspended solids and organic matter from wastewater. It is generally accomplished by chemical addition or filtration.

- Secondary: The water after primary treatment overflows to the secondary stage which degrades the biodegradable organic matter. Generally this is done through Aerobic Biological Media. The micro-organisms in this stage consume biodegradable organic matter and consume the dissolved oxygen in the process. Some of the commonly used processes are Activated Sludge, Trickling Bed Filters, Constructed Wetlands, Moving Bed Bio-film Reactors (MBBR) etc.
- Secondary with nutrient removal: Removal of Biodegradable Organics, Suspended Solids and Nutrients (Phosphorous, Nitrogen or both).
- Tertiary: Removal of residual suspended particles through granular medium filtration or micro screens.

The typical Industrial effluent treatment carried out has slight modifications as follows:

- The Industrial wastewater generally have extreme pH, which can affect the subsequent treatment steps, thereby neutralization is carried out at first place to neutralize the detrimental effect that the pH may have on the subsequent steps.
- In the next stage chemical/ biological treatment is carried out.
- Finally adsorption is done to remove remaining organic matter, metals and others which remain unaffected from the two previous stages.

During primary treatment (neutralization of the wastewater), the concentration of salts increase in the effluent and these salts in high concentration obstruct biological activity and may cause a rise in non-settleable suspended solids in the treated wastewater. The adsorption process is also obstructed due to the high concentration of salts.

Considering the above situation the present research work focuses on Adsorption performance of Low-Cost Adsorbent Natural Clay. The adsorption of effluents on clay samples was examined. The samples of industrial wastewater were taken for this purpose including Chemical Manufacturing Industry, Textile Industries (Dyeing and Finishing), Dairy industry and Paper mill. Clay samples were taken from local areas of Gujarat, (Mostly from the area of Suredranagar). Chemical Analysis of all clay samples was taken to study their mineral composition. Effluent samples were treated with clay by shaking process. Different parameters of industrial effluents were analyzed and studied before and after the clay treatment and the difference between them was recorded. In the present study Natural Clay was used as Low Cost Adsorbent for the removal of pollutants & impurities from industrial wastewater samples collected from six different industries. After review & verifying data & results it was concluded that Natural Clay can be used as an efficient & effective Low Cost Adsorbent for the adsorption of contaminants in the industrial wastewater. The color of the industrial wastewater samples can be colorless or lightened after adsorption which clearly means the colored or visible pollutant or compounds are adsorbed on Natural Clay adsorbent. Other parameters like, pH, Conductivity, Total Dissolved Solids (TDS), Chloride Ions, Hardness, Acidity & COD were determined before & after clay treatment. The results revealed that the Natural Clay could be used as an Adsorbent for the treatment of industrial wastewater as it is very cheap and has no hazardous side-effects. It effectively removes the pollutant & contaminants from industrial effluent.

Use of Clay for Industrial Wastewater Treatment:

○ Clay

Clay is a finely ground powder of rocks or it is a soil material which combines with clay minerals with trace amount of metal oxides and organic materials.



Figure 1: Types of Clay

○ Clay Minerals

Clay minerals are the Hydrated Aluminium Phyllosilicates (e.g. kaolin, $Al_2Si_2O_5(OH)_4$). Sometimes they have variable amount of alkali metals, alkaline earth metals, magnesium, iron and other cations. The structure of clay is similar to the micas and hence both make flat hexagonal sheets. In finely ground sedimentary rocks like, Mudstone, Siltstone and Shale and in finely ground metamorphic Slate and Phyllite, the clay minerals are generally present.

Following groups are included in clay minerals:

- Kaolinite Group: the minerals like Kaolinite, Dickite, Halloysite & Nacrite.
- Serpentine Group: structural similarities
- Smectite Group: Pyrophyllite, Talc, Vermiculite, Saponite, Nontronite & Montmorillonite.
- Illite Group: Clay-Micas. Illite is the only common mineral.
- Chlorite Group: Wide variety of similar minerals with considerable chemical variation.

When industrial wastewater is treated with different types of clays, the adsorption takes place. The contaminant molecules are adsorbed on the surface of Ground Clay.

II. MATERIAL AND METHODOLOGY

Industrial Wastewater:

Industrial wastewater is the biggest source of water pollution of water bodies and ground water. Depending on the nature of the industry the characteristics of wastewater may vary broadly in its pH, Temperature, Colour, Odour, Turbidity, Oil, Grease, Hardness, Conductivity, Salinity, presence of Sulphates, Chlorides, Cyanides, Solids, Metals etc. The wastewater from dye industry are specifically characterized by Colour, extreme pH in addition to presence of un-reacted raw materials, by-products, and products.

Effluent Collection and Preservation:

For this research work, wastewater samples were collected as per follow:

Sample 1: Chemical Manufacturing Industry, Vatva, Ahmedabad

Sample 2: Textile Industry (Finishing), Pirana, Ahmedabad

Sample 3: Dairy Industry, Gandhinagar

Sample 4: Textile Industries (Dyeing), Narol, Ahmedabad

Sample 5: Textile Industry (Dyeing), Ahmedabad

Sample 6: Paper Industry, Surendranagar

Wastewater samples were collected in 1 liter labeled carboys, sealed. Carboy filled to the brim to avoid any oxidation or contamination. Complete and absolute preservation of wastewater samples is practically not possible, because complete stability for every constituent can never be achieved, but all protocols were followed to ensure that the chemical and biological changes are suppressed to the maximum possible extent.

Low Cost Adsorbent Natural Clay:

Natural Clay samples were taken from different areas of Gujarat mostly from Surendranagar & Khambhat and they are labeled as Sample-A, Sample-B, Sample-C & Sample-D. They were collected from

Sample-A: Muli, Surendranagar

Sample-B: Chotila, Surendranagar

Sample-C: Dhrangadhra, Surendranagar

Sample-D: Khambhat, Anand

EXPERIMENTAL METHODS:

Filtration

Sample No. 1 (Industrial Wastewater) was taken in a beaker. Filtration apparatus was set and the sample was poured on filter paper. The filtrate was collected in the beaker while residue was left on the filter paper. All six samples of industrial wastewater were filtered in the same way. The color of samples before and after filtration was noted.



Figure-2: Color of Samples Before Filtration



Figure-3: Color of Samples After Filtration

Preparation of Clay Sample:

All clay samples (Sample-A, Sample-B, Sample-C & Sample-D) were individually grind to a fine powder and then washed. The washed clay was then dried on a filter paper in a pre-heated oven for 48 hours. It was grinded again for further process.

Treatment of Clay with Industrial Wastewater Samples:

10 g of clay Sample-A was taken in a conical flask. 100 ml of industrial wastewater Sample-1 was poured into the flask & shaken well. Similarly 10,10g of the same clay sample was taken in five more flasks and 100 ml of same water sample was poured in each flask. The flasks were shaken and set on the shaker for 20 minutes. The speed was set at 200 rpm.

After shaking, the samples were filtered and all of the parameters, which were determined before this treatment.

All remained industrial wastewater samples were treated with remained clay samples and parameters were studied.

III. RESULTS AND CONCLUSION

❖ Chemical Analysis of Clay Samples:

Chemical analysis of Clay Samples were conducted third party for this study. So, we have not discussed the methodology chemical analysis of Clay Samples. I have sent all Clay Samples to the Laboratory Located in Ahmedabad for Chemical Analysis. Samples of the Clay are as follows:

- Sample-A: Muli, Surendranagar
- Sample-B: Chotila, Surendranagar
- Sample-C: Dhrangadhra, Surendranagar
- Sample-D: Khambhat, Anand

Table 1: Chemical Analysis of Clay Samples

Constituents	Sample-A	Sample-B	Sample-C	Sample-D	Minimum	Maximum	Average
Loss on Ignition (LOI)	14.67	12.37	9.12	16.21	9.12	16.21	13.09
SiO ₂	49.51	58.12	69.62	56.40	49.51	69.62	58.41
Al ₂ O ₃	32.54	21.19	14.34	13.65	13.65	32.54	20.43
K ₂ O	0.78	0.57	0.17	0.86	0.17	0.86	0.60
Fe ₂ O ₃	0.91	5.17	2.85	3.14	0.91	5.17	3.02
Na ₂ O	0.53	0.94	0.42	0.45	0.42	0.94	0.59
MgO	0.58	0.65	0.36	1.06	0.36	1.06	0.66
CaO	0.48	0.98	3.12	8.23	0.48	8.23	3.20

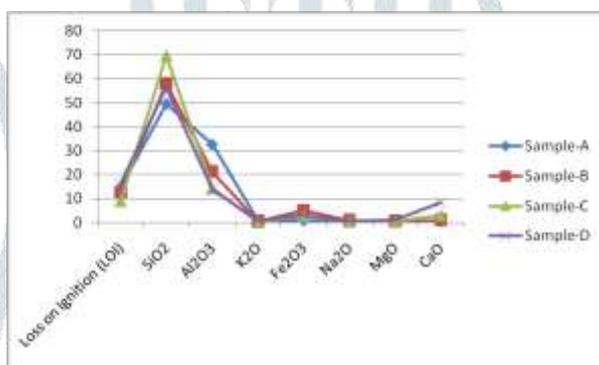


Figure 4: Chemical Analysis of Clay Samples

❖ Chemical Analysis of Industrial Wastewater before Clay Treatment :

Chemical analysis of all six industrial wastewater samples before Clay Treatment were conducted and results of the same are in bellow Table-2

Parameters	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6
Color	Colorless	Light Blue	Light Brown	Ink blue	Brown	Pale Yellow
pH	2.93	8.23	8.45	6.3	7.05	7.9
Conductivity (µS/cm)	7117	12366	3394	25686	25578	5084
TDS (mg/L)	4626	8036	2204	16696	16650	7824
Cl ⁻ (mg/L)	2961	3945	697	3600	3642	1248
Hardness (mg/L)	6960	1860	612	2414	2458	1560
Acidity (mg/L of CaCO ₃)	560	120	88	108	94	104
COD	5000	4200	2080	8000	7818	6024

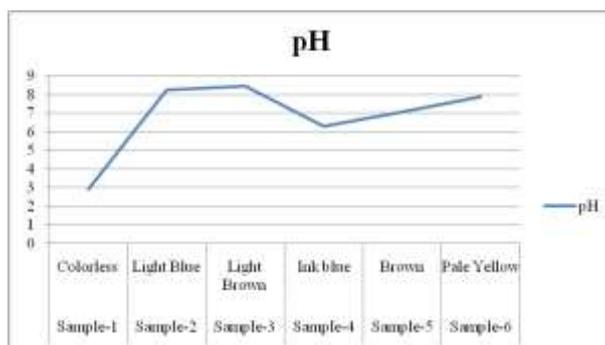


Figure3: pH of Wastewater Samples Before Clay Treatment

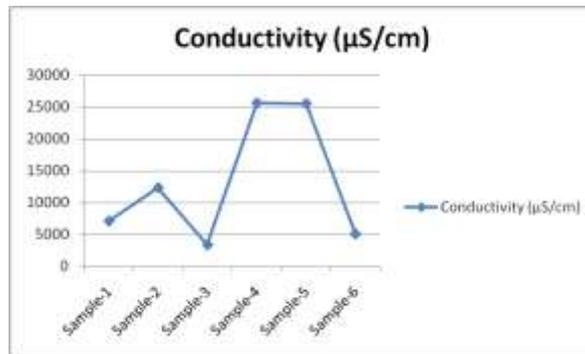


Figure 4: Conductivity of Wastewater Samples Before Clay Treatment

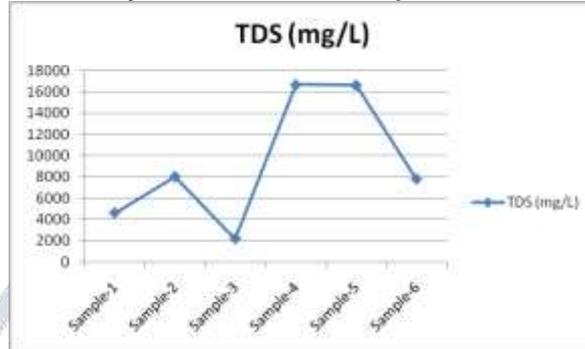


Figure 5: TDS (mg/L) of Wastewater Samples Before Clay Treatment

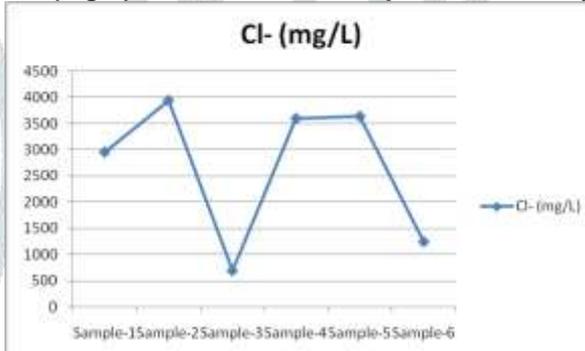


Figure 6: Cl- (mg/L) of Wastewater Samples Before Clay Treatment

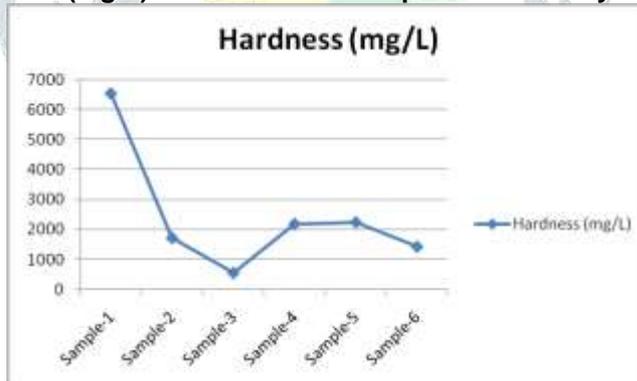


Figure 7: Hardness (mg/L) of Wastewater Samples Before Clay Treatment

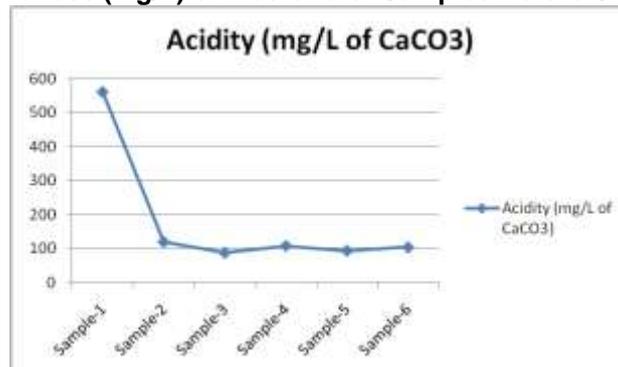


Figure 8: Acidity (mg/L of CaCO₃) of Wastewater Samples Before Clay Treatment

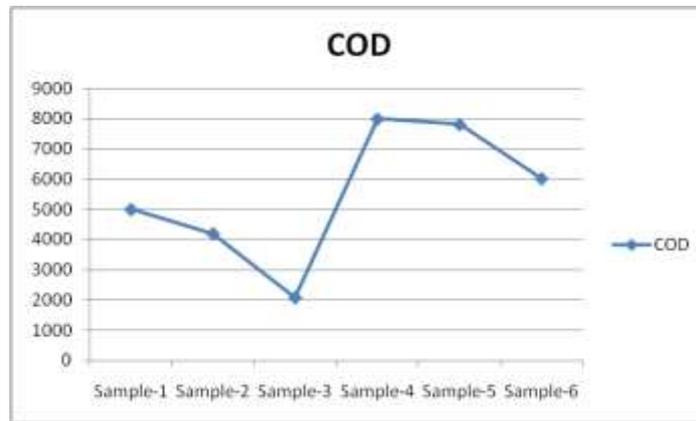


Figure 9: COD of Wastewater Samples Before Clay Treatment

❖ **Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-A :**

Chemical analysis of all six industrial wastewater samples after treatment with Clay Sample-A was conducted and results of the same are in Table No. 5.3. Values of different parameters of industrial wastewater after clay treatment showed that value of all of the parameters were changed after clay treatment.

Table No.: 3 Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-A:

Parameters	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6
Color	Colorless	Nearly colorless	Light brown	Light blue	Pale blue	Colorless
pH	3.22	7.59	7.69	6.89	7.23	7.26
Conductivity (µS/cm)	6555	11500	3122	23374	23403	4677
TDS (mg/L)	4270	7473	2027	15193	15234	7198
Cl ⁻ (mg/L)	2080	3795	641	3550	3576	1148
Hardness (mg/L)	6542	1729	563	2196	2249	1435
Acidity (mg/L of CaCO ₃)	526	111	80.9	98.2	86	95.6
COD	4700	3906	1913.6	7280	7153.47	5542.08

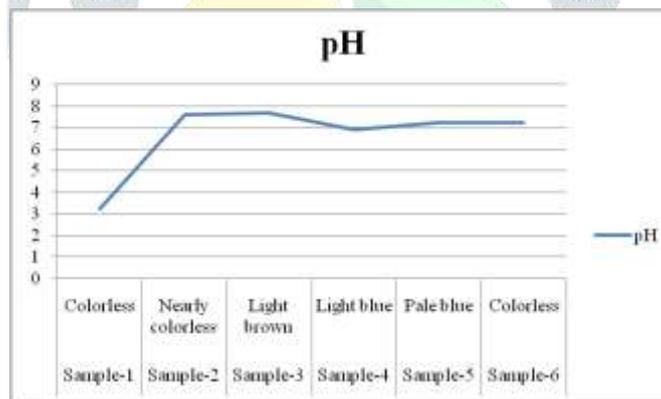


Figure 10: pH of Wastewater Samples after Treatment Clay Sample-A

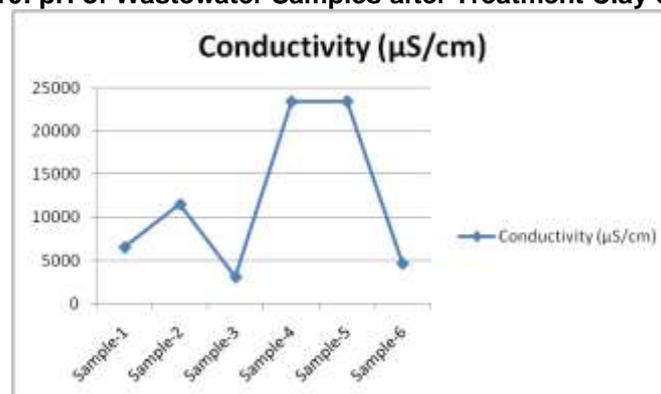


Figure 11: Conductivity of Wastewater Samples after Treatment Clay Sample-A

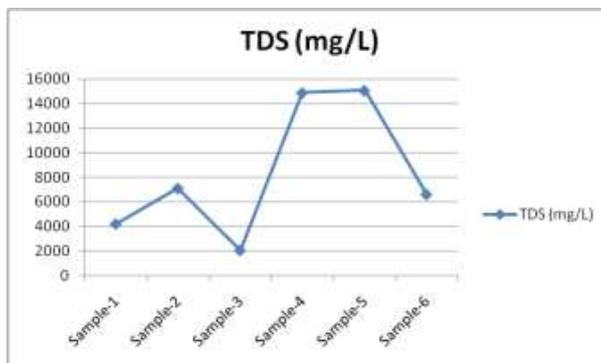


Figure 12: TDS (mg/L) of Wastewater Samples after Treatment Clay Sample-A

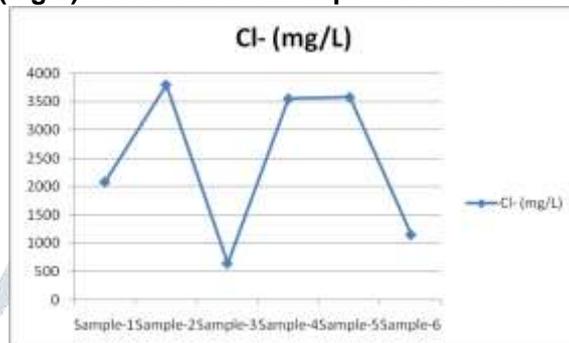


Figure 13: Cl⁻ (mg/L) of Wastewater Samples after Treatment Clay Sample-A

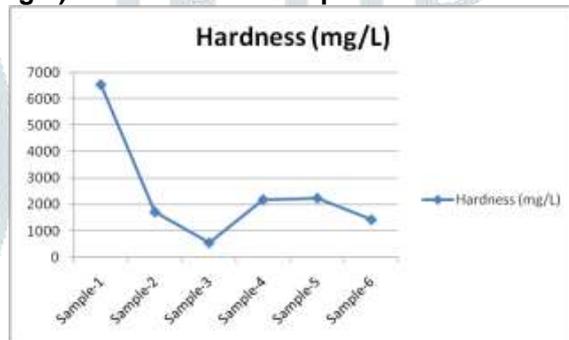


Figure 14: Hardness (mg/L) of Wastewater Samples after Treatment Clay Sample-A

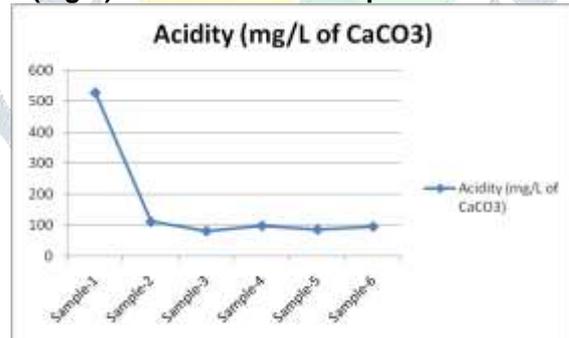


Figure 15: Acidity (mg/L of CaCO₃) of Wastewater Samples after Treatment Clay Sample-A

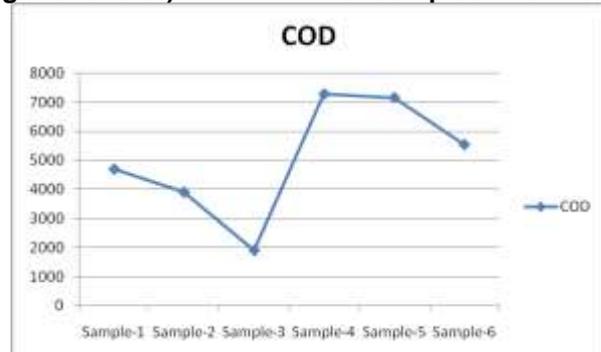


Figure 16: COD of Wastewater Samples after Treatment Clay Sample-A

Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-A show change in value of all parameters. After treatment with Clay Sample-A the color of Sample 3, 4 and 5 little light but Sample 1, 2 & 5 became colorless. pH of all samples were increased slightly Conductivity was higher in Sample- 4 & 5 and least in Sample-3, overall conductivity was decreased for all samples after treatment. TDS was higher in Sample-4 & 5 and least in Sample-3, overall TDS was decreased for all samples after treatment. The chloride amount was maximum in sample 2, 4 & 5 and least in Sample-3, but overall chloride was decreased for all samples after treatment. The hardness was maximum for sample 1 and minimum in Sample-3, but overall hardness was decreased for all samples after treatment. Acidity was highest in Sample-1 & Least in Sample-3, but Acidity was decreased for all samples after treatment. COD was highest in Sample-5 & least in Sample-3, but COD was decreased slightly for all samples after treatment.

❖ **Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-B :**

Chemical analysis of all six industrial wastewater samples after treatment with Clay Sample-B was conducted and results of the same are in Table No. 5.4. Values of different parameters of industrial wastewater after clay treatment showed that value of all of the parameters were changed after clay treatment.

Table No.: 4 Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-B:

Parameters	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6
Color	Colorless	Colorless	Nearly Colorless	Light blue	Nearly Colorless	Colorless
pH	3.28	7.56	7.87	6.97	7.34	7.3
Conductivity ($\mu\text{S}/\text{cm}$)	6434	10900	3100	22900	23210	4590
TDS (mg/L)	4180	7080	2012	14887	15080	6590
Cl ⁻ (mg/L)	2028	3607	698	3650	3768	1230
Hardness (mg/L)	6340	1656	563	2100	2210	1320
Acidity (mg/L of CaCO ₃)	540	119	82	95	89	99
COD	4576	3950	1900	7190	7217	5401

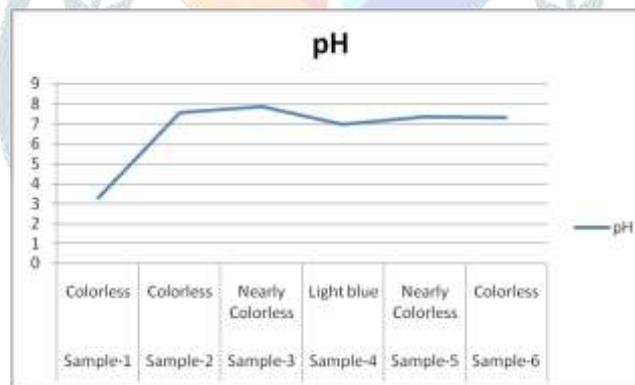


Figure 17: pH of Wastewater Samples after Treatment Clay Sample-B

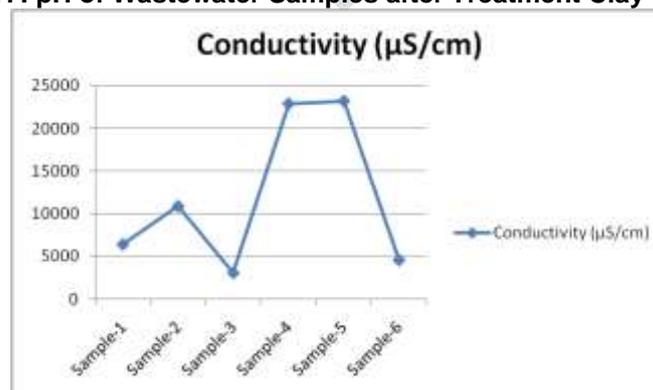


Figure 18: Conductivity of Wastewater Samples after Treatment Clay Sample-B

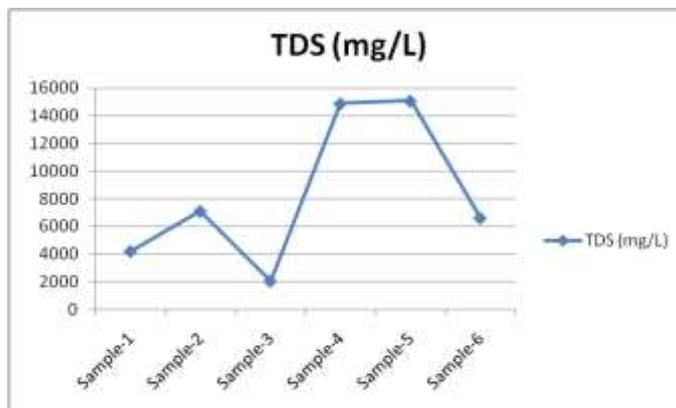


Figure 19: TDS (mg/L) of Wastewater Samples after Treatment Clay Sample-B

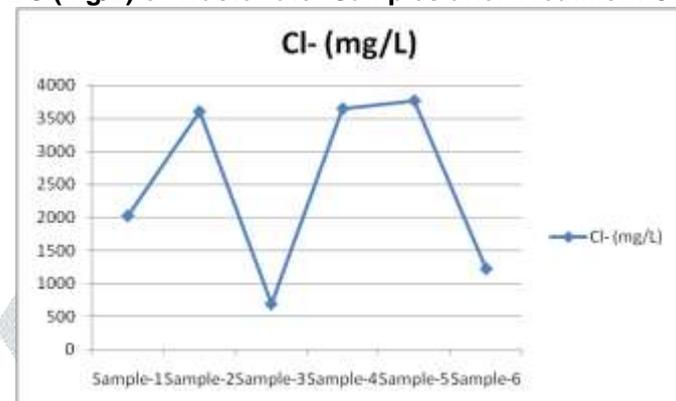


Figure 20: Cl⁻ (mg/L) of Wastewater Samples after Treatment Clay Sample-B

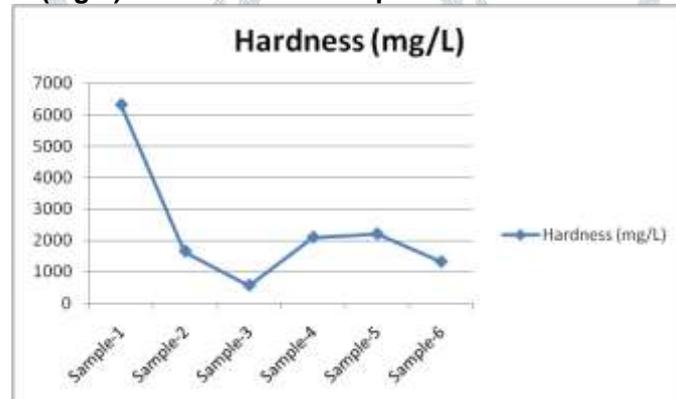


Figure 21: Hardness (mg/L) of Wastewater Samples after Treatment Clay Sample-B

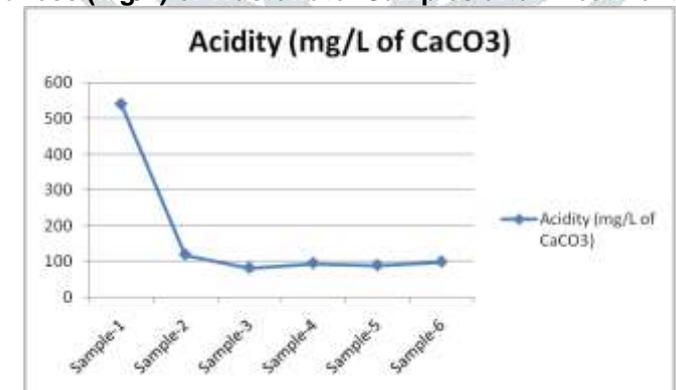


Figure 22: Acidity (mg/L of CaCO₃) of Wastewater Samples after Treatment Clay Sample-B

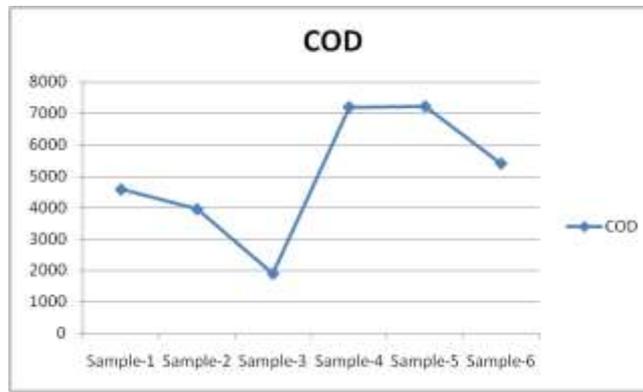


Figure 23: COD of Wastewater Samples after Treatment Clay Sample-B

Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-B show change in value of all parameters. After treatment with Clay Sample-B the color of Sample 3, 4 became little light but Sample 1, 2, 3, 5, 6 became colorless. pH of all samples were increased slightly. Conductivity was higher in Sample- 4 & 5 and least in Sample-3, overall conductivity was decreased for all samples after treatment. TDS was higher in Sample-4 & 5 and least in Sample-3, overall TDS was decreased for all samples after treatment. The chloride amount was maximum in sample 2, 4 & 5 and least in Sample-3, but overall chloride was decreased for all samples after treatment. The hardness was maximum for sample 1 and minimum in Sample-3, but overall hardness was decreased for all samples after treatment. Acidity was highest in Sample-1 & Least in Sample-3, but Acidity was decreased for all samples after treatment. COD was highest in Sample-5 & least in Sample-3, but COD was decreased slightly for all samples after treatment.

❖ **Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-C :**

Chemical analysis of all six industrial wastewater samples after treatment with Clay Sample-C was conducted and results of the same are in Table No. 5.5. Values of different parameters of industrial wastewater after clay treatment showed that value of all of the parameters were changed after clay treatment.

Table No.: 5 Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-C:

Parameters	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6
Color	Colorless	Colorless	Nearly Colorless	Light blue	Nearly Colorless	Colorless
pH	3.28	7.56	7.87	6.97	7.34	7.3
Conductivity (µS/cm)	6434	10900	3100	22900	23210	4590
TDS (mg/L)	4180	7080	2012	14887	15080	6590
Cl ⁻ (mg/L)	2028	3607	698	3650	3768	1230
Hardness (mg/L)	6340	1656	563	2100	2210	1320
Acidity (mg/L of CaCO ₃)	540	119	82	95	89	99
COD	4576	3950	1900	7190	7217	5401

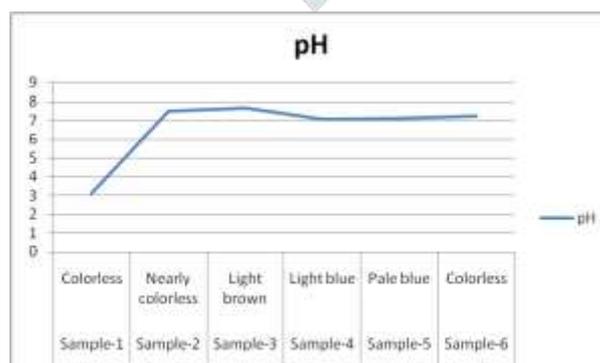


Figure 24: pH of Wastewater Samples after Treatment Clay Sample-C

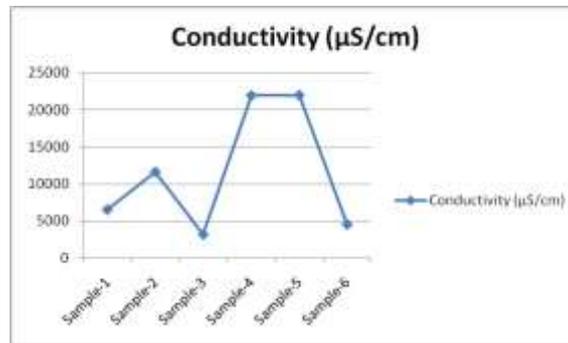


Figure 25: Conductivity of Wastewater Samples after Treatment Clay Sample-C

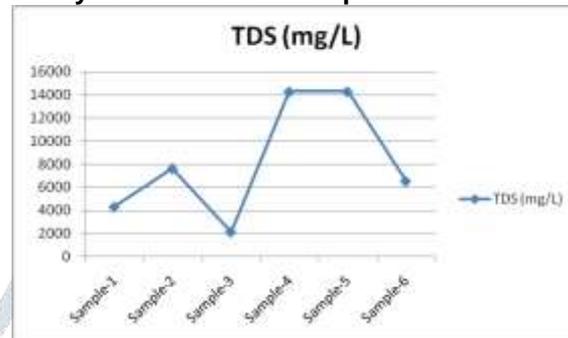


Figure 26: TDS (mg/L) of Wastewater Samples after Treatment Clay Sample-C

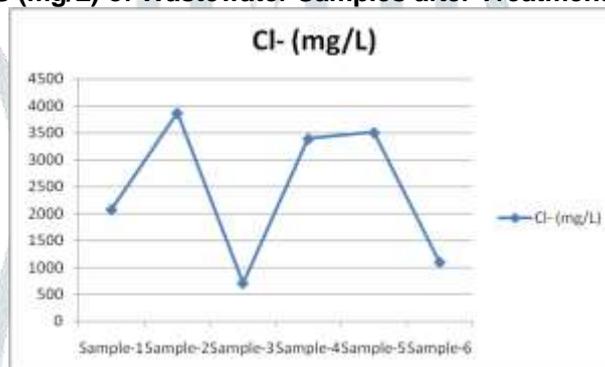


Figure 27: Cl⁻ (mg/L) of Wastewater Samples after Treatment Clay Sample-C

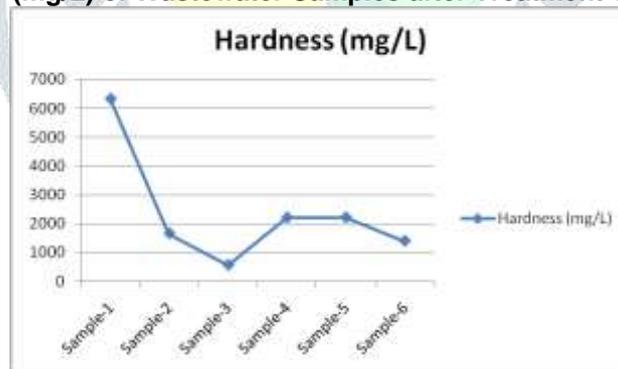


Figure 28: Hardness (mg/L) of Wastewater Samples after Treatment Clay Sample-C

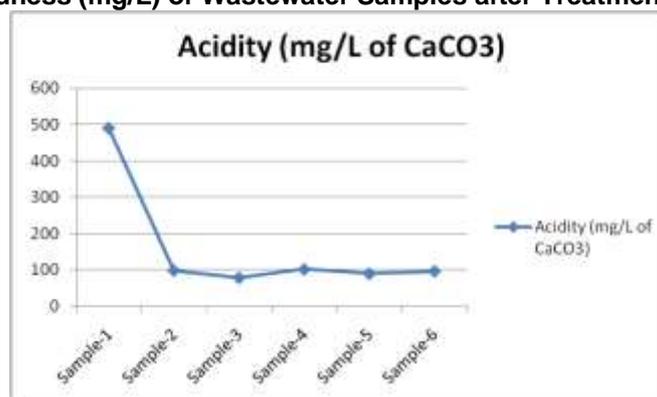


Figure 29: Acidity (mg/L of CaCO₃) of Wastewater Samples after Treatment Clay Sample-C

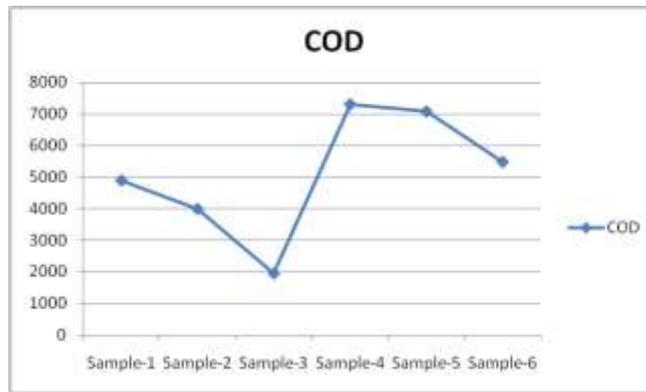


Figure : COD of Wastewater Samples after Treatment Clay Sample-C

Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-C show change in value of all parameters. After treatment with Clay Sample-C the color of Sample 2, 3, 4 & 5 became little light but Sample 1 & 6 became colorless. pH of samples 1,4 5 were increased slightly. Conductivity was higher in Sample- 4 & 5 and least in Sample-3, overall conductivity was decreased for all samples after treatment. TDS was higher in Sample-4 & 5 and least in Sample-3, overall TDS was decreased for all samples after treatment. The chloride amount was maximum in sample 2, 4 & 5 and least in Sample-3, but overall chloride was decreased for all samples after treatment. The hardness was maximum for sample 1 and minimum in Sample-3, but overall hardness was decreased for all samples after treatment. Acidity was highest in Sample-1 & Least in Sample-3, but Acidity was decreased for all samples after treatment. COD was highest in Sample-4 & least in Sample-3, but COD was decreased slightly for all samples after treatment.

❖ **Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-D:**

Table No.: 6 Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-D:

Parameters	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6
Color	Colorless	Colorless	Nearly Colorless	Light blue	Nearly Colorless	Colorless
pH	3.33	7.75	7.65	7.11	7.23	7.51
Conductivity (µS/cm)	6326	10854	3138	22848	23128	4432
TDS (mg/L)	4112	7050	2040	14846	15033	6438
Cl⁻ (mg/L)	1998	3590	650	3510	3620	1219
Hardness (mg/L)	6132	1685	541	2326	2312	1432
Acidity (mg/L of CaCO₃)	543	108	75	102	79	86
COD	4410	3875	1883	7409	7456	5510

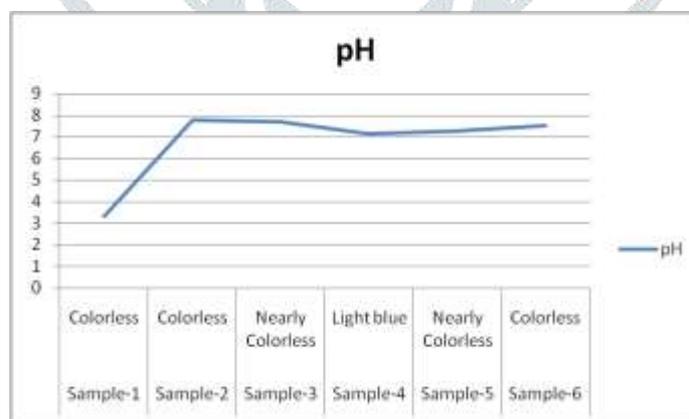


Figure 31: pH of Wastewater Samples after Treatment Clay Sample-D

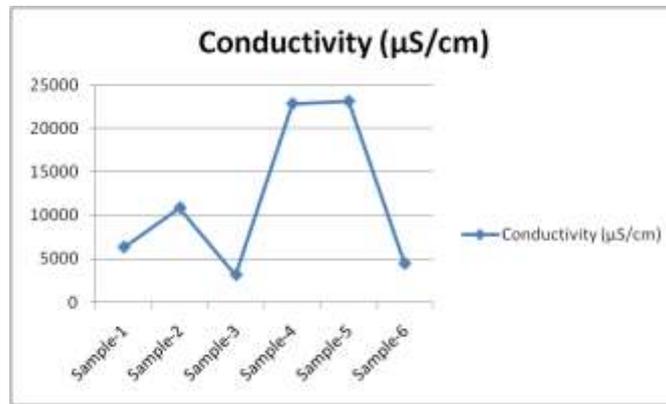


Figure 32: Conductivity of Wastewater Samples after Treatment Clay Sample-D

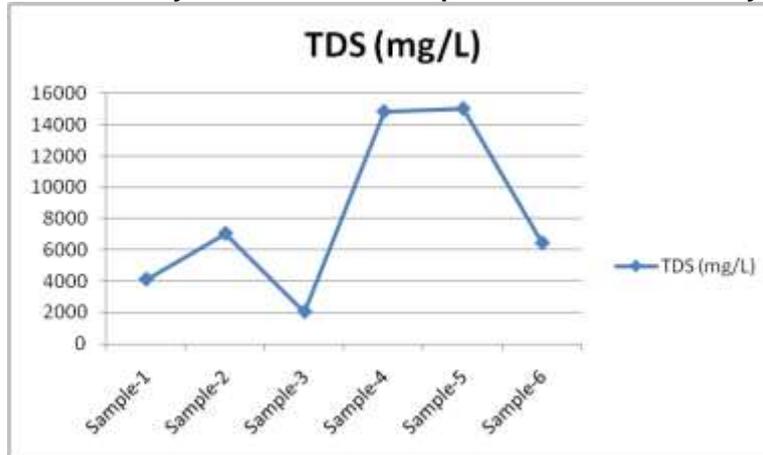


Figure 33: TDS (mg/L) of Wastewater Samples after Treatment Clay Sample-D

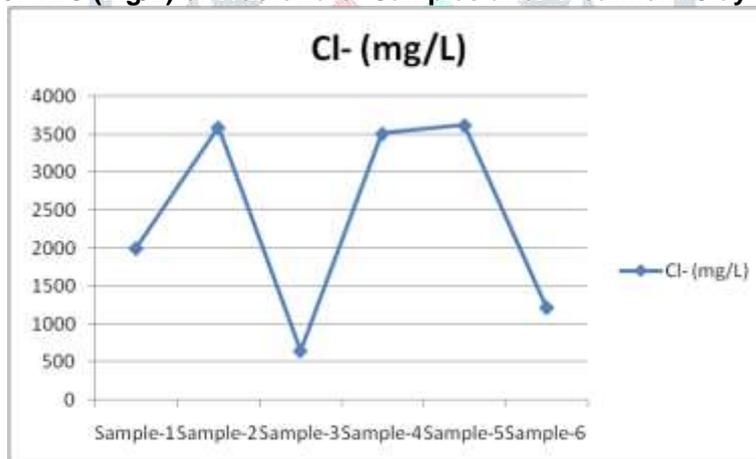


Figure 34: Cl⁻ (mg/L) of Wastewater Samples after Treatment Clay Sample-D

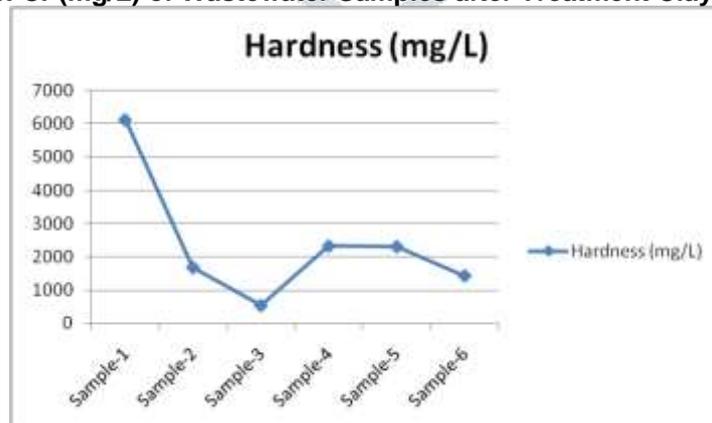


Figure 35: Hardness (mg/L) of Wastewater Samples after Treatment Clay Sample-D

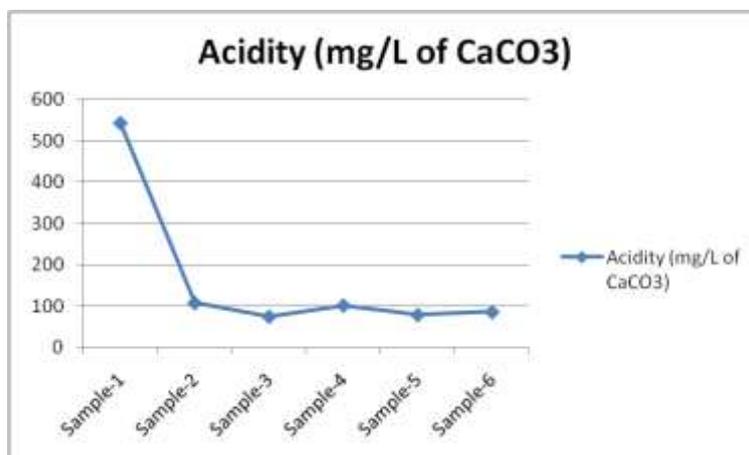


Figure 36: Acidity (mg/L of CaCO₃) of Wastewater Samples after Treatment Clay Sample-D

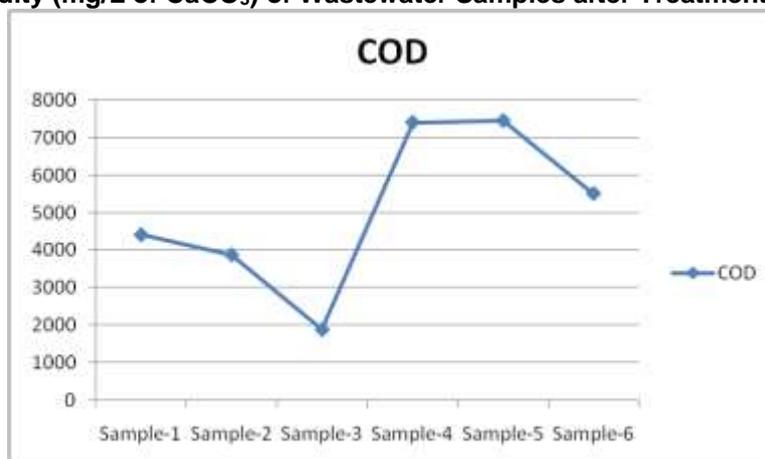


Figure 37: COD of Wastewater Samples after Treatment Clay Sample-D

Chemical Analysis of Industrial Wastewater after Treatment with Clay Sample-D show change in value of all parameters. After treatment with Clay Sample-D the color of Sample 4 became little light but Sample 1, 2, 3, 5, 6 became colorless. pH of samples 1, 4, 5 were increased slightly. Conductivity was higher in Sample- 4 & 5 and least in Sample-3, overall conductivity was decreased for all samples after treatment. TDS was higher in Sample-4 & 5 and least in Sample-3, overall TDS was decreased for all samples after treatment. The chloride amount was maximum in sample 2, 4 & 5 and least in Sample-3, but overall chloride was decreased for all samples after treatment. The hardness was maximum for sample 1 and minimum in Sample-3, but overall hardness was decreased for all samples after treatment. Acidity was highest in Sample-1 & Least in Sample-3, but Acidity was decreased for all samples after treatment. COD was highest in Sample-5 & least in Sample-3, but COD was decreased slightly for all samples after treatment.

IV. CONCLUSION:

In the present study Natural Clay was used as Low Cost Adsorbent for the removal of pollutants & impurities from industrial wastewater samples collected from six different industries. After review & verifying data & results it was concluded that Natural Clay can be used as an efficient & effective Low Cost Adsorbent for the adsorption of contaminants in the industrial wastewater. The color of the industrial wastewater samples can be colorless or lightened after adsorption which clearly means the colored or visible pollutant or compounds are adsorbed on Natural Clay adsorbent. Other parameters like, pH, Conductivity, Total Dissolved Solids (TDS), Chloride Ions, Hardness, Acidity & COD were determined before & after clay treatment.

The results concluded that:

- In our present study 10 g of Natural lay Sample was taken in a conical flask. 100 ml of industrial wastewater Sample was poured into the flask & shaken. The flasks were shaken and set on the shaker for 20 minutes. The speed was set at 200 rpm. After shaking, the samples were filtered and parameters (pH, Conductivity, Total Dissolved Solids (TDS), Chloride Ions, Hardness, Acidity & COD) determined before & after Natural Clay treatment.
- pH of Acidic wastewater samples collected from Chemical Manufacturing Industry & Textile Industry after Natural Clay Treatment became basic. pH of other samples also decreased and became neutral from alkaline in Textile Industry (Finishing), Dairy Industry, Paper Industry & Textile Industry(Dyeing)
- Conductivity of all six industrial wastewater samples was decreased considerably after Natural Clay treatment.
- Chloride of all industrial wastewater samples decreased after Natural Clay Treatment
- TDS, Acidity, Hardness & COD also decreased considerably in all six samples of industrial wastewater by Natural Clay Treatment.

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