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Influence of Wastewater PH on Turbidity

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Abstract

Water is undoubtedly the most vital parameter among the natural resources. In modern societies proper management of wastewater is a necessity, not an option. pH is an important limiting chemical factor for aquatic life. If the water in a stream is too acidic or basic, the H^+ or OH^- ion activity may disrupt aquatic organisms' biochemical reactions by either harming or killing the stream organisms. Wastewater pH has been identified as one of the parameters which influence effective wastewater treatment; (Juttner et al, 2000); (Aboulhassan et al, 2006). Turbidity in wastewater is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms. Turbid water has muddy or cloudy appearance and it is aesthetically unattractive. The turbidity increases as sewages become stronger. Turbidity imparts an enormous problem in waste water treatment. Various research studies exclaimed that the influence of the pH on the system found to be significant showing positive and negative correlation on turbidity removal. In present study researcher is trying to find out certain correlation between pH & turbidity in waste water for remediation in Phagwara, Punjab.

Keywords: Water Quality Assessment, pH, Turbidity, Correlation coefficient, Phagwara etc.

1. Conceptual Background of the Study

The impulsive shift of the human community from the traditional lifestyle to modernization and urbanization involved the destruction of valuable non-renewable natural resources and disintegration of the environment. Hence billions of gallons of wastes discharged from cities, housing settlements, industries and agricultural processes are poured into freshwater bodies every day, which alter its pH, turbidity and other original properties.

pH is a measure of hydrogen ion concentration in water. In other words, it is the acid or alkaline condition of water. Several factors like temperature, aeration and input from external source also interfere with the pH.

The presence of suspended particulates in water inhabiting the passage of light through it is termed as turbidity. To make this definition simpler, it can be expressed as 'visual interference'. The suspended particles may be colloidal or coarse dispersions and their size decides the degree of turbulence.

pH of the effluent determines the type of treatment to be given. In waste water treatment, pH is an important criterion for coagulation of turbidity removal, disinfection, water softening and corrosion control.

2. Literature Review

Ntwampe *et al.* (2013) worked on the effect of water hardness on paint wastewater treatment by coagulation-flocculation. A 169.2 g of paint was diluted in 1 L potable water. A 200 ml of the sample was poured into six 500 ml glass beakers and dosed with 0.043 M $FeCl_3$, 0.043 M of $Al_2(SO_4)_3$ or $AlCl_3$, respectively employing varying dosing sequence and varying dosages before and after mixing in a jar test to determine turbidity removal efficiency. Samples were stirred at 250 rpm for 2 min and 100 rpm for 10 min, settled for 1 h after which the pH and turbidity were measured. In a second set of experiments, the samples were dosed with combined 0.043 M $FeCl_3$ and 0.043 M $Ca(OH)_2$ or 0.043 M $Mg(OH)_2$. In a third set of experiments, the samples were dosed with 0.043 M $FeCl_3$-$Ca(OH)_2$ or 0.043 M $FeCl_3$-$Mg(OH)_2$ of synthetic polymers. The results from the first and the second sets of experiments showed that pH correlates with turbidity removal, dosing before or during mixing do not play a significant role in wastewater treatment. There is no correlation between pH and turbidity from the results in the third sets of experiments. It indicates that pH is not a direct indicator of turbidity in the treatment of more alkaline solution.

i. Zhang *et al.* (2012) investigated the influence of absorbency, turbidity and suspended substance in printing wastewater treatment by regulating the pH value of water treatment. Firstly, was acidified the wastewater samples to 5, 4, 3, 2, then alkalize them to 8, 9, 10, 11, 12. Calculated decolorization removal, turbidity removal and the suspended substance removal. The results show that, the decolorization removal and the turbidity removal were low after acidification. While after alkalized treatment the decolorization removal and the turbidity removal were all rise.
ii. Altaher & Alghamdi (2011) worked on Enhancement of Quality of Secondary Industrial Wastewater Effluent by Coagulation Process: A Case Study in Yanbu Industrial City, Kingdom of Saudi Arabia. They found that the pH of the wastewater had an important effect on turbidity removal efficiency. The highest removal efficiency was found at higher pH. Even without the addition

of coagulant a considerable part of the turbidity would precipitate at elevated pH.

3. Research Area & Importance of the Study

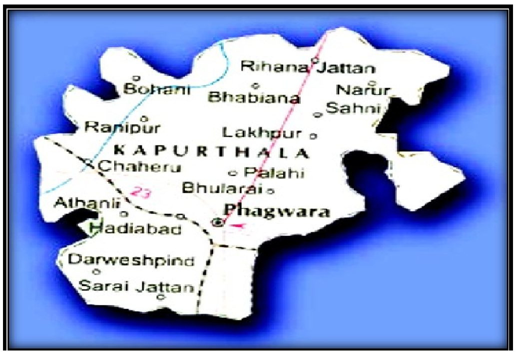

Fig. 1: Phagwara in Kapurthala Distt.

Fig. 2: Industrial Area of Phagwara.

Punjab is the richest state of India and sound developed in industrial and agricultural process. Phagwara is main industrial center in the Kapurthala distict of Punjab because of its good location on the national highway. This city has many different types of industries like, Guru Nanak Autos (GNA), Wahid Sandhar Sugar Mill, Jagjit Cotton Textile (JCT) Mills, Dairy Industry, Leather Industry etc., which release numerous industrial effluent and sewages into a naturally made Ganda Nala which enter into Phagwara city from Hoshiarpur district that is three kilometers away from Phagwara city and runs twelve kilometers through Phagwara tehsil and finally meet with the river Kali Baien. These effluents and sewages affect its surrounding environment in numerous ways such as polluting air, water bodies, and agricultural land. The present study will be helpful to find out a correlation between pH and turbidity to adopt better treatment for the waste water of Phagwara.

4. Objectives & Hypothesis Formulation

Ob.1. To determine the pH & Turbidity content in the wastewater of Phagwara.

Ob.2. To access them on the basis of Water Quality Index.

Ob.3. To find out the correlation between pH & Turbidity in wastewater of Phagwara.

H_1. There exist certain correlation between pH & Turbidity in wastewater of Phagwara.

5. Experimental Design

5.1. To measure the pH of the wastewater sample

Material required & Procedure: pH meter, Buffer solution 4 and 9.

Standard pH tablets are commercially available. Dissolve the appropriate pH tablet in 100 ml distilled water.

Procedure: Warming up the instrument for 15 minutes before use. Adjusted the pH knob to read 7 and carefully connecting the electrode with the pH meter. Washed the electrode in distilled water, wiped it dry and the immersed it in the buffer solution (4.0). Adjust the temperature knob to the temperature range of buffer. Similarly adjust the buffer knob to the pH of the buffer solution, i.e.4. Now turn the selector switch to zero position. Washing the electrode with distilled water, wiped it dry and immersed it in the buffer solution of pH 9.2 and dipped the electrode in the sample. According to the pH range of the sample, adjust the selector switch to either 0-7 or 7-14. Read the pH of the sample. Remove the sample; shift the selector switch again to zero position. Put off the instrument. Always kept the electrodes dipped in distilled water.

5.2. To measure the Turbidity of the wastewater sample

Material Required: Nephelometer, Colourless and clean glass tubes for sample loading.

Standard Solution: Solution (a) 1 g of hydrazine sulphate is dissolved in 10 ml of distilled water.

Solution (b) 1 g of lexam ethylene tetramine in 10 ml of distilled water.

Transferring 5 ml each from solution (a) and (b) in a 100 ml volumetric flask and leaved it undisturbed for one full day at 25^0C. Make up to 100 for one month from the stock solution is 400. This solution can be used for one month from the stock solution. Pipette out 1 ml and make up to 100 ml using distilled water (40 NTU).

Procedure: Adjusting the nephelometer at 100 using 40 NTU. Then transfer the sample into the nephelometer tube. See to it that the sample did not contain any air bubble during measurement. Read out the value on the scale. If the sample processed an NTU greater than 40, diluted it using distilled water and repeat the procedure as described above.

6. Sampling Station & Techniques

Midstream samples were collected in wide mouthed polythene bottles from naturally made Ganda Nala, Phagwara and leveled. They were collected on definite seven sampling stations with more or less similar distance in 15 days interval from January 2009 to December 2011.

Fig. 3: Sampling Station (Naturally made Ganda Nala of Phagwara)

7. Data Collection & Interpretation

The data obtained from analyzed samples are tabulated and interpreted with the **Water Quality Index (http://www.water-research.net/watqualindex/index.htm).**

Table 1: Water Quality Index Legend.

Range	90-100	70-90	50-70	25-50	0-25
Quality	Excellent	Good	Medium	Bad	Very bad

7.1 Tabulation & Graphical Presentation of Data

Table 2 (a): Values of pH

SN	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
1	**2009**	8.80	8.85	8.90	8.92	8.91	8.96	8.98	9.02	8.95	8.93	8.96	8.98	**8.93**
2	**2010**	8.85	8.80	8.78	8.10	8.00	8.75	8.85	8.20	8.80	8.90	8.00	8.60	**8.55**
3	**2011**	8.35	8.33	8.39	8.37	8.35	8.31	8.29	8.30	8.25	8.22	8.33	8.25	**8.31**
Average		**8.67**	**8.66**	**8.69**	**8.46**	**8.42**	**8.67**	**8.71**	**8.51**	**8.67**	**8.68**	**8.43**	**8.61**	**8.60**

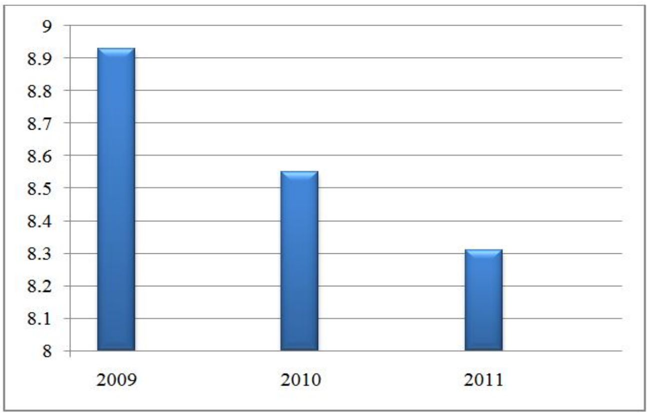

Fig. 4: Average pH content.

Table 3: Values of Turbidity (NTU).

SN	**Year**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Avg.**
1	**2009**	37.33	38.10	39.20	40.80	39.50	43.10	43.20	43.30	42.10	39.00	38.50	37.22	**40.11**
2	**2010**	40.10	40.20	40.10	41.40	41.20	42.30	42.50	42.80	41.80	41.20	40.30	40.50	**41.20**
3	**2011**	41.20	41.80	41.50	41.90	42.20	42.50	42.30	42.90	43.24	42.50	42.00	40.00	**42.00**
Average		**39.54**	**40.03**	**40.27**	**41.37**	**40.97**	**42.63**	**42.67**	**43.00**	**42.38**	**40.90**	**40.27**	**39.24**	**41.10**

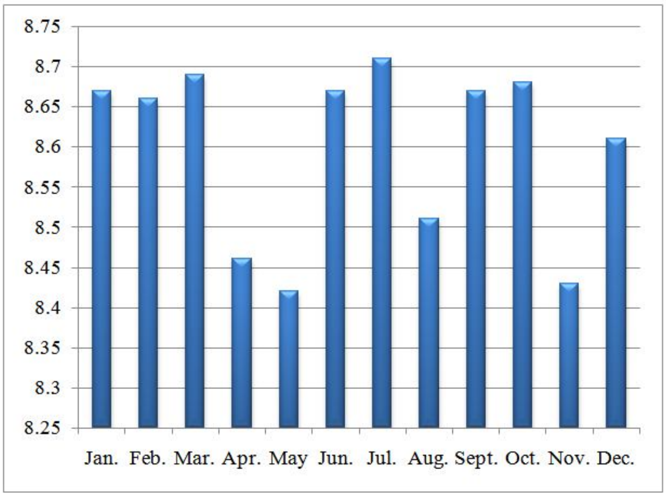

Figure 5: Average pH content.

From the above data and graphic representation of pH content in the wastewater of Phagwara shows that the pH is alkaline in nature, but it decreasing from 2009 to 2011 & it also varies in different months due to the flush water and presence of aquatic bodies. The highest average pH was observed in the month of July 8.71 and the lowest in the month of May 8.42. The average pH in 3 years was 8.60.

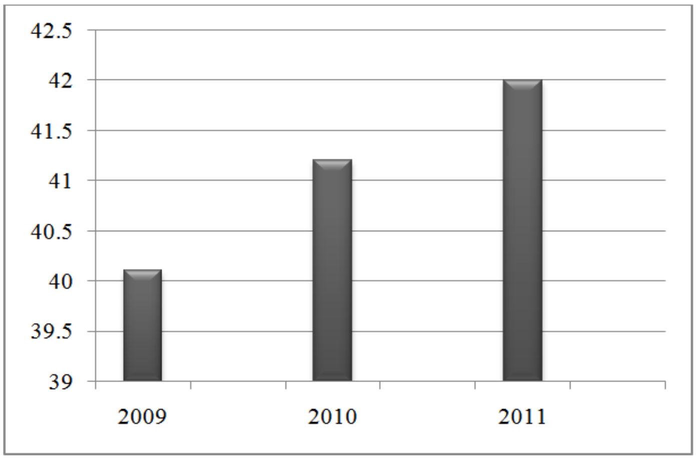

Figure 6: Average Turbidity (NTU) content.

From the above data & graphical representation of turbidity content in wastewater of Phagwara indicates that it is in increasing order from 2009 to 2011. The minimum average turbidity was noted in the month of December 39.24 NTU and maximum in the month of August 43.00 NTU. The average turbidity in 3 years was noted 41.10.

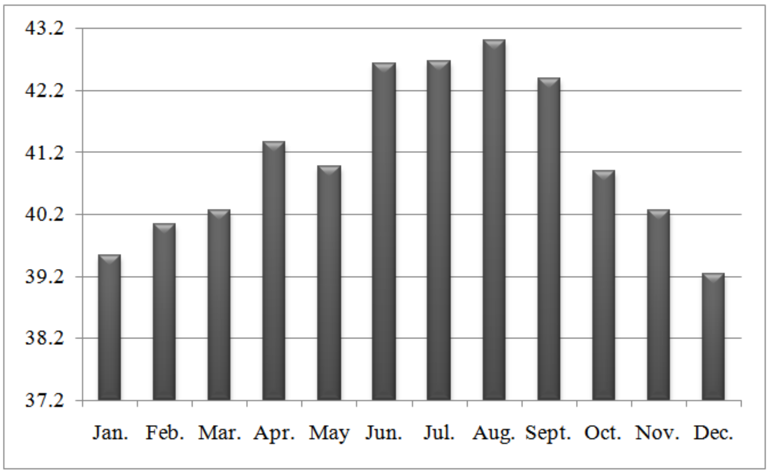

Figure 7: Average Turbidity (NTU) content.

8. Result and Discussion

Table 4: Average data of pH & Turbidity.

Turbidity	39.54	40.03	40.27	41.37	40.97	42.63	42.67	43	42.38	40.9	40.27	39.24
pH	8.67	8.66	8.69	8.46	8.42	8.67	8.71	8.51	8.67	8.68	8.43	8.61

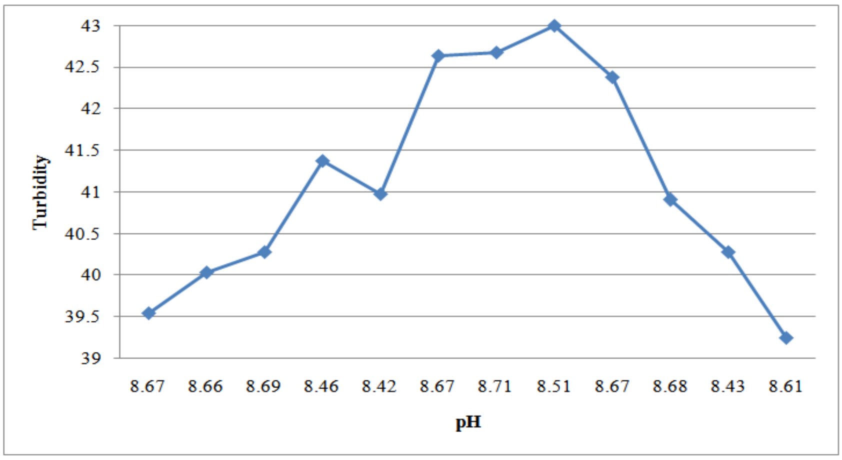

Fig. 8: Influence of pH on Turbidity.

Table 5: Statistical Data of pH & Turbidity.

Variable	**Mean**	**Standard Deviation (δ)**	**Correlation coefficient (r)**
pH	8.60	0.113298	0.115361
Turbidity (NTU)	41.10	1.300332	

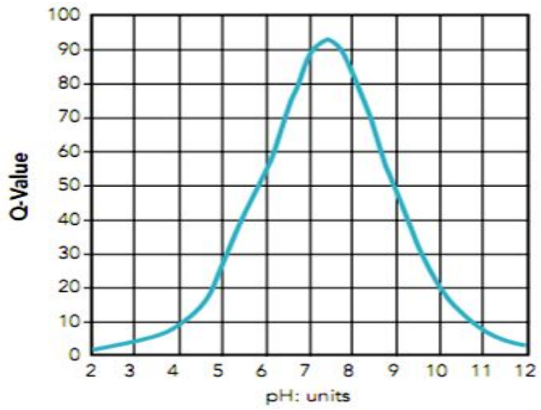

Chart 1: Water Quality Index: pH

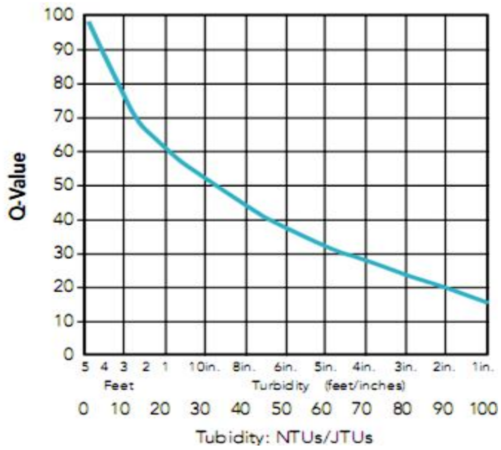

Chart 2: Water Quality Index: Turbidity

Note**:** If turbidity is greater than 100 NTU, the quality index equals 5.

The results show that the average pH is 8.60 & SD 0.113298 which indicates the data are varies in month wise. The Q-value of pH lies between 80-90, i.e. good for growth of aquatic living organisms in the wastewater.

The water quality and the average turbidity is 41.10 NTU & SD 1.300332 which also indicates the more variations in turbidity. The Q-value of turbidity lies between 39-43 NTU, which indicate the bad quality in terms of turbidity.

The correlation coefficient (r) of pH & turbidity shows 0.115361, which indicates there is very low insignificant positive correlations. Thus the research hypothesis is partially rejected and the alternative hypothesis is that there exist insignificant positive correlations between pH & turbidity in wastewater of Phagwara.

9. Conclusion

From the above discussion it is obvious that there is no direct influence of wastewater pH on turbidity significantly but there exist certain insignificant positive correlation with other factors in wastewater of Phagwara.

10.Acknowledgement

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