

# Appraisal of water quality index of textile effluent for agricultural irrigation

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## ABSTRACT

The calculation of Water Quality Index of an effluent is a simplest and best method to know the quality of an effluent. The important Physico-chemical parameters for irrigation was analyzed from the collected textile effluent and Water Quality Index of textile effluent was calculated from the measurement of Physico-chemical parameters made, which reveals that the WQI of the study effluent was severe. So, from the study it is advised not to use the effluent directly before proper treatment or dilution for agricultural irrigation because the property of effluent may disturb the aim of usage.

**Key words:** Effluent, Irrigation, Textile, Quality.

## Introduction

The development of modern industrialization leads to fast degradation of our environment. Water is indispensable and one of the precious natural resources of this planet. Industrial effluent may be an alternative source of water supply for irrigation, industries and domestic usage where perennial surface water sources are absent. Increasing demand for water from industrial sectors resulted in stress on the water resources both from quantity and quality perspectives (Hemamalini *et al.*, 2017). It can be used after it is analyzed, effluent can be analyzed for its quality by evaluating the Water Quality Index of an effluent. Water Quality Index of an effluent is a best and easiest method to know the quality of wastewater effluent. The quality of an effluent is described by its Physico-chemical parameters. The characteristics of these parameters are interlinked and correlations between the various parameters measured are helpful to assess its quality. WQI

gives a single indicator on water quality depending, on important parameters. In general, a water quality index is incorporate data from the information of different water quality parameters into a numerical condition that rates the soundness of water system with number (Vinod *et al.*, 2013).

The Physico-chemical characterizations of industrial wastewater effluent are totally wanted to analyze the quality of an effluent. Hence it was programmed to analyze the Physico-chemical characterization of textile effluent and calculation of its Water quality Index for agricultural irrigation.

## Materials and Methods

### Collection of effluent

Effluent was collected in a pre sterilized 25 liter plastic container after two rinses with the effluent. After proper collection, the sample was immediately brought to the laboratory and preserved for future analysis.

**Sample Preservation and Analysis**

The collected samples were preserved as per the standard preservation technique. The effluent samples were always kept in a suitable container in a refrigerator at 15 – 20° C. The effluent samples were taken out from the refrigerator only at the time of analyses. The Physico-chemical parameters of the effluent were determined (APHA, 2012).

Percent Sodium (%)

Percent sodium was calculated by using the formula with values in me q<sup>-1</sup> (Wilcox, 1955)

$$\% \text{ Na} = \frac{(\text{Na} + \text{K}) \times 100}{\text{Ca} + \text{Mg} + \text{Na} + \text{K}}$$

**Water Quality Index (WQI)**

Water Quality index was measured by taking six important parameters with the standards of discharge of trade effluent on land for irrigation by TNPCB (Tamil Nadu Pollution Control Board) P. MS. No. 30 Dated 21.02.1984, the allotted weights (Punmia, 1977) as shown in the following table.

WQI calculation was made as per the method modified (Harton, 1965 and Tiwari *et al.*, 1985). Weight (wi) for the selected parameters were allocated based on the importance of the parameters on water quality. For example, important parameters such as percent sodium, chloride and sulphate were

allocated with 4, 4 and 3 weights and other parameters weight (wi) were allocated based on the importance and its incidence for surface irrigation. The unit weight (uwi) was calculated for ith parameter (i=1,2,.....6 in our case ) using the following relation.

$$uwi = \frac{wi}{\sum wi} \text{---? } \sum uwi=1 \quad .. (1)$$

Which ensure that  $\sum uwi = 1 \quad I = 1 \quad .. (2)$

The calculated unit weights for the parameters were given in the above table. Each parameter was divided into five intervals according to its range. The following table describes the quality index (qi) with range of value and its extent of pollution in descriptive terms.

Finally, WQI is calculated by totaling the all multiplications of qi and uwi.

i.e.  $WQI = \sum qiuwi$

WQI – ≥ 100 is Ideal limit, WQI – 99 to 75 is Slight, WQI – 74 to 50 is Moderate, WQI – 49 to 25 is Extreme and WQI – 24 to 0 is Severe.

**Results and Discussion**

The Physico-chemical characterization of the study effluent was represented in Table 1. In the Physico-chemical parameters analyzed, pH, TSS, Sulphate were within the limit of TNPCB standard for irriga-

Standards for irrigation water

S. No.	Parameters	Standard (si)	Weight(wi)	Unit weight(uwi)
1	pH	5.5 to 9	1	0.06
2	Total Suspended solids (mg/L)	200	2	0.13
3	Total Dissolved solids (mg/L)	2100	2	0.13
4	Chloride (mg/L)	600	4	0.25
5	Sulphate (mg/L)	1000	3	0.19
6	Percent Sodium %	60	4	0.25
				1.0

Range of Values and Extent of Pollution

S.No	Parameters	Extent of pollution				
		Ideal	Slight	Moderate	Extreme	Severe
1	pH	5.5-6.3	6.4-7.2	7.3-8.1	8.2-9.0	<5.5>9.0
2	TSS (mg/L)	0-50	51-100	101-150	151-200	>200
3	TDS (mg/L)	0-525	526-1050	1051-1575	1576-2100	>2100
4	Chloride (mg/L)	0-150	151-300	301-450	451-600	>600
5	Sulphate (mg/L)	0-250	251-500	501-750	751-000	>1000
6	Percent Sodium %	0-15	16-30	31-45	46-60	>60
	(qi)	100	75	50	25	0

**Table 1.** Physico-chemical characterization of Textile effluent with standard of TNPCB

S. No.	Parameters	Textile Industry effluent	Standard Value (TNPCB)
1	pH	8.14	5.5 to 9
2	TSS	177	200
3	TDS	6841	2100
4	Sodium	624	-
5	Potassium	63	-
6	Calcium	154	-
7	Magnesium	51	-
8	Chloride	843	600
9	Sulphate	569	1000
10	Percent Sodium %	70.5	60

\*All the values are expressed in mg L<sup>-1</sup> except pH and Percent Sodium

**Table 2.** Water Quality Index of Textile effluent

S. No.	Parameters	Standard Value (TNPCB)	Rating(qi)	Unit weight(wi)	Product (qiwi)
1	pH	5.5 to 9	50	0.06	3
2	TSS	200	25	0.13	3.25
3	TDS	2100	0	0.13	0
4	Chloride	600	0	0.25	0
5	Sulphate	1000	50	0.19	9.5
6	Percent Sodium %	60	0	0.25	0

Water Quality Index = 15.75

tion but TDS, Chloride and Percent Sodium were exceed the range of the limit. The WQI of textile effluent was represented in Table 2. Water Quality Index was calculated based on the measurement of Physico-chemical parameters analyzed for irrigation and the calculated WQI of the textile effluent was 15.75 and this was severe. This severe may be because of the higher concentrations of the Physico-chemical parameters which exceeded the standard limit. Similarly the wastewater of tannery was also severe and recommended not to use the wastewater directly for irrigation (Mathan and Venkatesan, 2020). Periyasamy and Rajan (2009) reported WQI of electroplating effluent was between slight to moderate and it is not appropriate for irrigation. Vinod *et al.* (2013) assessed the WQI of surface water around steel plant industry and recommended not to use it before proper treatment. From this study it is concluded that, since the WQI of the study effluents was severe, it is advised not to use the effluent directly before treatment, because the property of effluent may disturb the aim of usage. The effluents can be utilized for irrigation after treatment or proper dilution.

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