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Determination of Pollution of Four River Water by Using Refractive Index Method

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***Abstract*: In Pune sample of four different river water Mula, Mutha, Indrayani and Pawana were collected on 27th January 2019 in day time. Refractive index of each river water was experimentally obtained using hollow glass prism, Spectrometer and monochromatic Sodium light source. Refractive index of all river water was compared with respect to Refractive index of tap water. It was found that Pawana river was most polluted and Mutha river was least polluted. The reason for Pawana River to be most polluted was the distance travelled through the industrial region was more as compare to other river.**

***Keywords*: Indrayani, mula, mutha, pawana pollution, refractive index**

1. Introduction

With the help of Shuster's method and prism formula Refractive index of tap water and four different river water was obtained using hollow glass prism, Spectrometer and monochromatic sodium source as a light source. The experiment was conducted at room temperature in month of January at Pune. Theoretical ideology that the rivers in PCMC are polluted was confirmed experimentally [1]. It is also concluded that industrial sector may be more responsible as compare to other sources for pollution of river water. It was found that Pawana river as compare to other river flows more through industrial area and thus was most polluted [1][2].

2. Experiment

Sample of four different river water Mula, Mutha, Pawana and Indrayani were collected on same day in month of January 2019. Horizontal alignment of prism table, collimator was done using spirit level. Monochromatic sodium source when emitted yellow bright light was used as a light source. Cross wire of telescope on fine slit was adjusted. Initially at room temperature tap water was filled in hollow glass prism. The prism filled with the tap water as a medium was placed on prism table with base parallel to telescope and collimator. Angle of minimum deviation was obtained using Shuster's method [3]. The procedure was repeated five times to obtain mean of angle of minimum deviation so as to reduce error. The Prism formula is given by

$$\mu = \frac{\sin\{[A+\int m]/2\}}{\sin[A/2]} \quad [4]$$

With the angle of prism A=60° prism formula reduces to

$$\mu = 2*\sin[(60+\int m)/2] \ldots\ldots\ldots (1)$$

Where $\int m$ is the mean of angle of minimum deviation and μ is the refractive index of medium. Using equation (1) refractive index of tap water was 1.3288. Similar procedure was used to find refractive index of Mula, Mutha, Indrayani and Pawana river at room temperature. Observation table to calculate refractive index of four different river water Mutha, Mula, Indrayani and Pawana are given below.

3. Result and Discussion

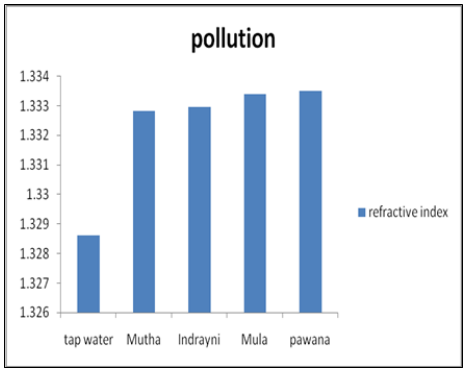

Fig. 1. Graph of refractive index(y axis) against name of river (x axis)

Bar graph of refractive index of medium against different medium was plotted. As expected Refractive index of each river water with respect to refractive index of tap water was more. Refractive index of medium depends on contamination [5]. If contamination of medium is more then refractive index of medium is more [5]. From graph we get to know that Pawana river was most polluted whereas Mutha river was least polluted river. Indrayani and Mula river were moderately polluted.

4. Conclusion

Pawana river flows through PCMC which is biggest industrial region [1] and hence was found to be more polluted [2]. Whereas Mutha river flows more through the rural area and thus was least polluted as compare to other three river [6]. These

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Table 1
Mutha river

S.No	∫m position		Direct reading		Difference		Mean
	A’	B’	A	B	A’-A	B’-B	∫m
1	288°51’	109°08’	265°07’	85°28’	23°44’	23°40’	23°42’
2	246°31’	66°37’	222°53’	42°58’	23°38’	23°39’	23°38’30”
3	232°16’	52°22’	208°40’	28°40’	23°36’	23°42’	23°39’
4	218°40’	38°35’	195°05’	15°0’	23°35’	23°35’	23°35’
5	205°24’	25°20’	182°04’	2°0’	23°20’	23°20’	23°20’

∫m= 23°34’54”
μ = 2*sin{[A+∫m]/2}
μ = 1.3328

Table 2
Mula river

S.No	∫m position		Direct reading		Difference		Mean
	A’	B’	A	B	A’-A	B’-B	∫m
1	11°18’	191°26’	347°09	167°55’	24°09’	23°31’	23°50’
2	175°59’	355°53’	152°30’	332°13’	23°29’	23°40’	23°34’30”
3	162°21’	342°04’	138°46’	318°30’	23°35’	23°34’	23°34’30”
4	148°45’	328°30’	125°15’	304°56’	23°30	23°34’	23°32’
5	135°06’	314°50’	111°30’	291°12’	23°36’	23°38’	23°37’

∫m = 23°37’36”μ = 2*sin{[A+∫m]/2} = 1.3334

Table 3
Pawana river

S.No	∫m position		Direct reading		Difference		Mean
	A’	B’	A	B	A’-A	B’-B	∫m
1	120°29’	300°10’	97°04’	276°48’	23°25’	23°22’	23°50’
2	105°18’	285°05’	82°	261°46’	23°18’	23°19’	23°34’30”
3	91°34’	271°19’	67°42’	247°34’	23°52’	23°45’	23°34’30”
4	76°30’	256°17’	52°37’	232°32	23°53’	23°45’	23°32’
5	61°20’	241°16’	37°29’	217°25’	23°57’	23°51’	23°30’

∫m = 23°38’06”, μ = 2*sin{[A+∫m]/2} = 1.3337

Table 4
Indrayni river

S.No	∫m position		Direct reading		Difference		Mean
	A’	B’	A	B	A’-A	B’-B	∫m
1	342°07’	162°19’	319°02’	139°22’	23°05’	22°57’	23°01’
2	326°13’	146°27’	303°09’	123°24’	23°04’	23°03’	23°03’30”
3	314°42’	134°51’	290°44’	110°57’	23°58’	23°54’	23°56’
4	303°55’	123°59’	279°50’	99°57’	24°05’	24°02’	24°03’30”
5	290°15’	110°18’	266°20’	86°26’	23°55’	23°52’	23°53’30”

∫m =23°35’30”. μ = 2*sin{[A+∫m]/2} = 1.3329

conclusions obtained by using refractive index method are verified with conclusions of other environmental researchers [1][2].

5. Future scope

If refractive index of different sample of same river is obtained by collecting sample at distance of 500 meter from its source point to the destination point then it would be easy to know that which area is most responsible for pollution.

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