IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 12, Issue 3 Ver. I (March. 2018), PP 32-36
www.iosrjournals.org

Measurement of Transparency Using Prakash- Dagaonkar Column Method at Mum Sager Talban Dear (M.P.), India

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Abstract: *Secchi-disc (1865) was introduced as method for measuring the Transparency of water. We introduce a new technique, P**rakash- Dagaonkar column** method, to isolate the limitation of human eye. There was a variation in the transparency measurement obtain by the traditional Secchi –disc method and new method.*

Key Words: *Transparency , Secchi-disc, Prakash- Dagaonkar column method,*

Date of Submission: 24-02-2018 Date of acceptance: 12-03-2018

I. Introduction

Water is the priceless gift of nature. From the beginning of human history, fresh water has been considered as a vital constituent for human survival. It has great social and economic values. Light is on of the most important factor which regulates the biological and ecological factor of any water body. Transparency of water may determine the balance between predator and prey in a particular water body at particular time, and may be the key in explaining individual behaviors, species interactions and community dynamics.

The Secchi disk is well known device used by the limnologist to measure transparency of water due to its simplicity and the utility value. Author is in agreement with the views of Preisendorfer (1986) and also of Suresh *et al.*(2006) who had suggested that deriving optical properties using Secchi depth would be futile and incorrect exercise

The Secchi disk originated with Fr. Pietro Angelo Secchi, an Italian astrophysicist, who used a white disk to measure the clarity of the water in the Mediterranean Sea in April 1865. Since then, the Secchi disk has been used to measure transparency of the water. It is the simplest method for estimating the transparency of water. The depth at which the Secchi disk disappears, known as the Secchi depth, is a measure of the transparency or the clarity of water. Clarity indicates how deep light can penetrate into the water. The higher the Secchi depth, the deeper the light penetrates into the water. Standard size of Secchi disk for limnological application is 20 cm, though its size may vary from 20 to 30 cm. Secchi disk with alternating black and white quadrants to improve contrast originated in 1899 by G.C. Whipple is known as "Whipple's" disk.

The Secchi depth depends on four parameters, a radiation source (sunlight), a medium that the radiation travels through (water), an object (the Secchi disk), and a sensor (our eye). In the newly designed instrument out of these four parameters two parameters namly Sacchi-disk and our eye has been replaced by a photocell and digital voltmeter respectively. As the measurement of transparency is based on the visibility theory, these replacement will improve the accuracy in measurement.

II. Material and Method

MATERIAL

About the water body

Munj Sagar is located in the district Dhar. It was excavated by Vakpati Munja (993AD), who was the famous rulers of Paramaras dynasty. Munja was a great general, a poet of repute and a great patron of art and literature. Munj Sagar Talab is geographically located at $22^0 30'06.67''$ North latitude and $75^0 17'42.67''$ East latitude. It covers an area of about 49.596 h The altitude of Munj Sagar Talab is 554m.In Year 2005 it was deepen by removing the bottom soil. This water body was basically constructed for drinking water purpose but Now-a days its water is mainly utilize for irrigation and fish culture

The sampling stations

Munj Sagar talab has mainly three Pakka Ghats . These ghats were chosen as sampling station. First one is Ganesh Ghat(S1) geographically located at $22^0 36'13.55''$ North latitude and $75^0 17'54.25''$ East latitude. Second is Shankar ghat (S2) geographically located at $22^0 36'05.28''$ North latitude and $75^0 17'59.66''$ East latitude and third is Chatri ghat (S3) geographically located at $22^0$35'58.34" North latitude and $75^0$17'45.82" East latitude .These sampling stations named as S1, S2 and S3 during the course of study .

III. Methods

PRAKASH- DAGAONKAR COLUMN METHOD

DESCRIPTION OF INSTRUMENT.

A cylindrical opaque plastic tube having a diameter of 10.16cm (4 inch) and length of 150 cm was taken. A photocell was fitted at the bottom of the tube in such a way that light sensing surface may remain perpendicular towards the top of tube and their should be no leakage of water from bottom. A digital voltmeter was attached to photocell in such a way that it may remain outside the tube so that reading of digital voltmeter were easily readable "Fig. 1" .

Procedure

Procedure for measurement of transparency starts with the filling of water in the tube. As the height of water colum increases in the tube penetration of light towards the bottom starts to decrease hence the reading of digital voltmeter starts to decreases. Zero reading of digital voltmeter shows that water column of tube had stopped the light to penetrate at bottom at this time of juncture filling of water is stopped. The height of water column measured with meter scale shows the transparency of water .

Secchi –disc Method.

Transparency of water was determined with the help of Secchi-disc. The disc tied with a marked string which was lowered down in the water until it disappeared and the length of rope was noted at this point. Then the disc was raised and at its reappearance the length of rope was again noted. The average of these two reading was considered as the limit of visibility

The result were calculated by following formula

Transparency in cm. (T) = (A+B)/2

Where

A= Depth at which Secchi-disc disappears(in cm).

B= Depth at which Secchi-disc reappears(in cm)

IV. Result

Transparency (Prakash-Dagaonkar Column) method.

Station S1 (Fig 2)

- **Range :-** 25.68 cm to 55.40 cm.
- **Minimum Transparency:-** 25.68 cm in the month of June 2008.
- **Maximum Transparency:-** 55.40 cm in the month of December 2007.

Station S2(Fig 3)

Range :- 26.00 cm to 52.67 cm.

- **Minimum Transparency:-** 26.00cm in the month of June 2008.
- **Maximum Transparency:-** 52.67 cm in the month of December 2007.

Station S3(Fig 4)

- **Range :-** 26.3 cm to 55.17 cm.
- **Minimum Transparency :-** 26.3cm in the month of June 2008.
- **Maximum Transparency -** 55.17 cm in the month of November 2007.

(Sacchi disc method)

Station S1 (Fig 2)

- **Range :-** 21.40 cm to 48.60 cm.
- **Minimum Transparency:-** 21.40 cm in the month of June 2008.
- **Maximum Transparency:-** 48.60 cm in the month of December 2007.

Station S2(Fig 3)

- **Range :-** 21.10 cm to 46.20 cm
- **Minimum Transparency:-** 21.10cm in the month of June 2008.
- **Maximum Transparency:-** 46.20 cm in the month of December 2007.

Station S3(Fig 4)
- **Range :-** 22.40 cm to 48.40 cm.
- **Minimum Transparency:-** 22.40 cm in the month of June 2008.
- **Maximum Transparency:-** 48.40 cm in the month of November 2007.

V. Discussion

The **Transparency** plays an important role in the penetration of light in to water layer. The transparency of water mainly affected by various factor such as biological productivity, suspended particles etc.

Kliamurthy (1973) has observed low transparency during pre monsoon and high during monsoon. Rajyalakshmi *et al.* (1988) reported a transparency range from 14cm to 26cm in Chilka lake. Sakhre and Joshi (2002) observed the transparency values 73-117cm in Palad-Nilagaon reservoir in Osmanabad (M.H.) with minimum value during August and maximum value in the month of March. Sehgal (2003) reported a range of 153-386 cm from Chohal reservoir Punjab. Devaraju *et al*. (2005) have discussed transparency ranging from 36.00 cm to 339.66 cm in Naktatra reservoir and from 131.0 cm to 339.66 cm in Muddur reservoir. Sharma *et al*. (2005) reported the transparency from 24 to 94 cm in Suptal Lake Jabalpur. Garg *et al*. (2005) recorded the transparency in between 48.75cm to 114.75cm in Harshi resevior Gwalior. Adarsh kumar *et al*. (2006) observed the transparency range from 120.5cm to 175.0 cm at Ranjit sagar reservoir of J&K with minimum value in the month of August and maximum in the month of April. Manimegalai *et al*. (2008) reported a range of transparency from 58cm to 79 cm in Ooty lake Karnataka with minimum value in June and Maximum in September. Sawant and Telave (2009) reported the range of transparency from 20-68 cm with seasonal variation in a water body of Gadhinglaj (Kolhapur). Namdeo and Shrivastava (2009) reported the average transparency value in Mahendra sagar as 32.5 cm and 41.85 in Shail sagar. Garg *et al*. (2010) described a transparency range from 66.59cm to 116.00 cm at Ramasagar(Datia ,M.P.) with high transparency during post monsoon period. Singh (2010) observed transparency value varied between 0.9m to 0.66m with low value during July and August

In the present study range of Transparency observed from 21.10 cm to 48.60 cm using Sachi disk and the variation from 25.68 cm to 55.40 cm was observed by PDC method. High value of transparency during winter and low during the summer season was may be due to low planktonic population in winter and high production during the summer which is in agreement with the finding of Timms & Midgley (1970) ; Sawant *et al*.(2010) and Garg *et al.* (2010).

VI. Figures and Tables

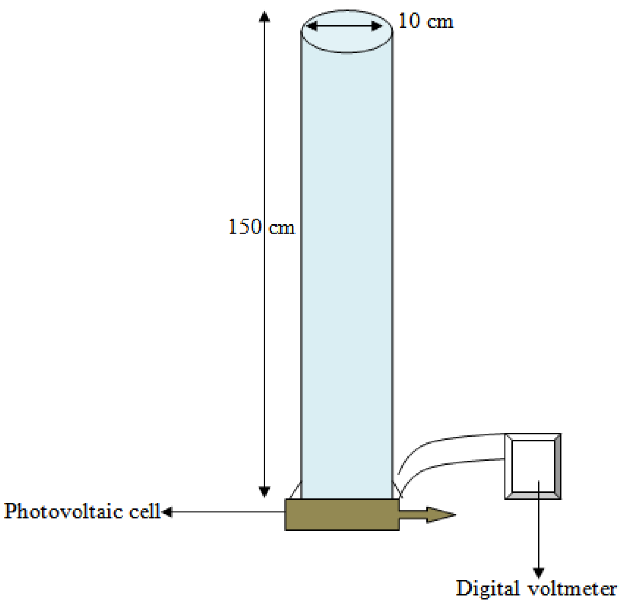

Fig.1 Ray diagram of prakash dagaonkar column instrument

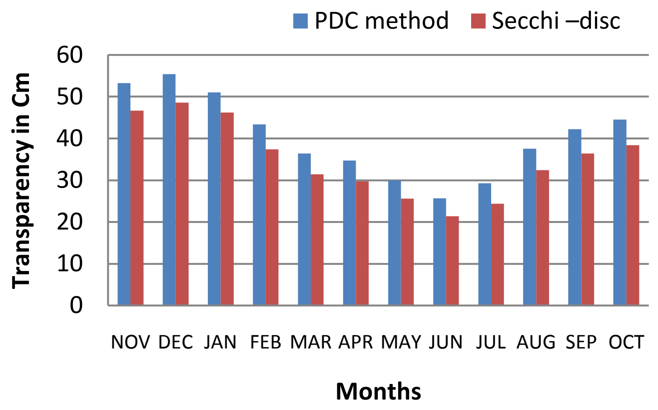

Fig 2 showing the monthly variaton at station 1

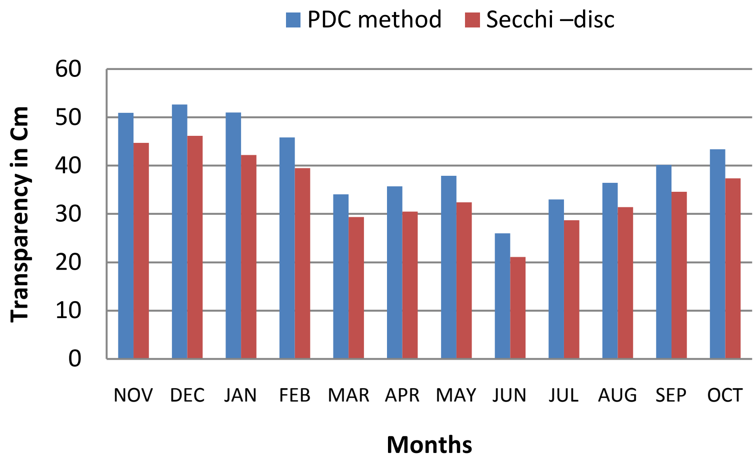

Fig 3 showing the monthly variaton at station 2

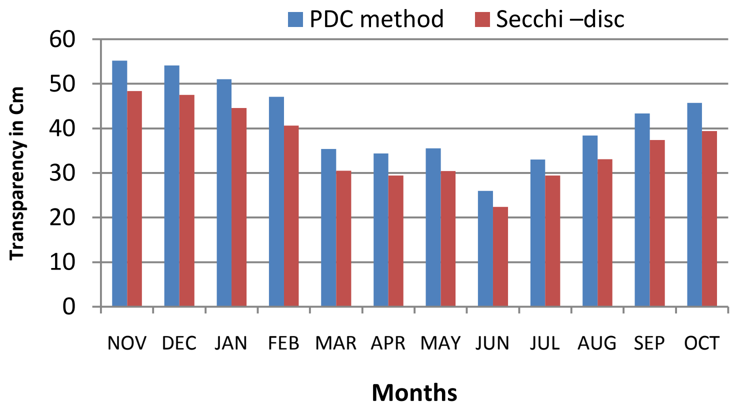

Fig 4 showing the monthly variaton at station 3

Table- 1: Monthly variations in Transparency of Mum sager tale, at station s1, s2 and s3

STATION	METHOD	NOV 07	DEC 07	JAN 08	FEB 08	MAR 08	APR 08	MAY 08	Just 08	JUL 08	AUG 08	SEP 08	OCT 08
S1	PDC method	53.24	55.40	51.00	43.38	36.42	34.75	29.95	25.68	29.28	37.58	42.22	44.54
	Sochi –disc	46.70	48.60	46.20	37.40	31.40	29.70	25.60	21.40	24.40	32.40	36.40	38.40
S2	PDC method	50.96	52.67	51.00	45.82	34.10	35.69	37.91	26.00	33.00	36.42	40.14	43.38
	Sochi –disc	44.70	46.20	42.20	39.50	29.40	30.50	32.40	21.10	28.70	31.40	34.60	37.40
S3	PDC method	55.18	54.15	51.00	47.10	35.38	34.39	35.56	26.00	33.00	38.39	43.38	45.70
	Sochi –disc	48.40	47.50	44.60	40.60	30.50	29.40	30.40	22.40	29.40	33.10	37.40	39.40

VII. Conclusions

a) Higher values of transparency for every observation indicate that the new instrument has overcome the limitation of the human eye.

b) Authors proposed following improvement in the instrument

I) the measurement of water column will be done by a microprocessor based
Device

II) Authors found that if the sunlight changes during the observation then the readings of transparency vary too much; so the measurement of transparency should be carried out at constant intensity for which a stable light source, like a bulb to be fitted on top of the tube.

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Dagaonkar Amita " Measurement of Transparency Using Prakash- Dagaonkar Column Method at Mum Sager Talban Dear (M.P.), India." IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) 12.3 (2018): 32-36.