



ISSN: 0975-833X

## RESEARCH ARTICLE

### QUANTITATIVE ESTIMATION OF DISSOLVED OXYGEN IN WATER: A NEW APPROACH TO THE CALCULATION METHODOLOGY OF WINKLAR'S METHOD

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#### ARTICLE INFO

##### Article History:

Received 07<sup>th</sup> July, 2014  
Received in revised form  
10<sup>th</sup> August, 2014  
Accepted 26<sup>th</sup> September, 2014  
Published online 25<sup>th</sup> October, 2014

##### Key words:

Method, Estimation,  
Dissolved, Oxygen,  
Winklar's Method.

#### ABSTRACT

Till date most acceptable method of estimation of dissolved oxygen in water sample is Winklar's method (APHA-2005). The method of calculation of data is followed by the formula  $V_1 \times N \times E \times 1000 / V_4 (V_2 - V_3 / V_2)$ .

Where,  $V_1$  = Quantity of the sample water.

$V_1$  = Quantity of sodium thiosulphate used in titration.

$N$  = Normality of sodium thiosulphate (N/80).

$V_4$  = Quantity of sample taken for titration.

$V_3$  = Quantity of alkaline iodite and manganese sulphate.

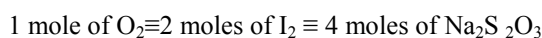
$E$  = Equivalent weight of  $O_2$ .

This formula can not explain a clear picture related to the chemical reaction takes place within the reagents used in this methodology. Therefore, an attempt has been made towards chemical deduction of data, available during estimation.

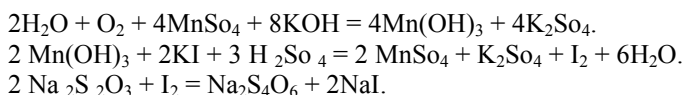
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#### Principles

Oxygen dissolved in water oxidises Manganous sulphate ( $MnSO_2$ ) to Manganic hydroxide [ $Mn(OH)_3$ ].  $Mn(OH)_3$  liberates Iodine ( $I_2$ ) from Potassium iodide (KI), alkalined with Potassium hydroxide (KOH), in presence of concentrated sulphuric acid ( $H_2SO_4$ ). The liberated iodine is quantitatively estimated by titration against N/80 sodium thiosulphate ( $Na_2S_2O_3$ ) solution from which amount of oxygen is determined by the following equations:-



#### Reactions



#### Apparatus

- 250 ml conical flask containing 250ml of sample water.
- Beaker.
- Burette.
- Stand.

#### Reagents

- 48% Manganous sulphate.
- Alkaline Potassium Iodide.
- Concentrated Sulphuric Acid.
- N/80 Sodium theosulphate solution.
- Freshly prepared starch solution.

#### Procedure (Winkler's Method, 1888)

- Water sample was collected (250 ml) with great care so that the air bubbles did not enter into the flask.
- 4 ml of  $MnSO_4$  and 4 ml of alkaline potassium iodide were added by using separate pipette for each reagent.
- The bottle was stopped & then the flask was shaken for several times and also allowed to precipitate.
- After 15 minutes the flask was gently shaken and then 4 ml of con.  $H_2SO_4$  was added to it.
- Then 50 ml of sample water is taken in a titration flask & placed against white back ground.
- It was then titrated by N/80  $Na_2S_2O_3$  solution till the colour turns pale yellow (straw).
- Then a few drops of freshly prepared starch solution was added to it and then the solution turns blue.
- Then it was again titrate with N/80  $Na_2S_2O_3$  till the blue colour disappeared. The end point is noted.
- This process is done for thrice for proper determination of dissolved oxygen.

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**RESULTS**

No. of Observation	Sample volume (ml)	Burette reading			Mean (ml)
		Initial (ml)	Final (ml)	Difference (ml)	
1.	50	8	11.5	3.5	
2.	50	11.5	15.1	3.6	3.5
3.	50	15.1	18.5	3.4	

**Calculation**

The amount of  $\text{Na}_2\text{S}_2\text{O}_3$  used is 3.5 ml.

From the reactions we may write that –

1 mol of  $\text{O}_2 \equiv 2 \text{ mol of I}_2 \equiv 4 \text{ mol of Na}_2\text{S}_2\text{O}_3$

4 mol of  $\text{Na}_2\text{S}_2\text{O}_3 \equiv 1 \text{ mol of O}_2$

$4 \times 158 \text{ gm of Na}_2\text{S}_2\text{O}_3 \equiv 32 \text{ gm of O}_2$

We know that,

1000 ml 1(N)  $\text{Na}_2\text{S}_2\text{O}_3$  contains 158 gm of this compound.

1000 ml 4 (N)  $\text{Na}_2\text{S}_2\text{O}_3$  contains  $4 \times 158$  gm of this compound.

So, 1000 ml 4 (N)  $\text{Na}_2\text{S}_2\text{O}_3 = 32$  gm of  $\text{O}_2$ .

1000 ml 1 (N)  $\text{Na}_2\text{S}_2\text{O}_3 \equiv 32/4$  gm of  $\text{O}_2 = 8$  gm of  $\text{O}_2$ .

1000 ml N/80  $\text{Na}_2\text{S}_2\text{O}_3 \equiv 8/80$  gm of  $\text{O}_2$ .

1 ml N/80  $\text{Na}_2\text{S}_2\text{O}_3 \equiv 8/80 \times 1000$  gm of  $\text{O}_2$   
 $\equiv 8 \times 1000 / 80 \times 1000$  mg of  $\text{O}_2 \equiv 1/10$  mg  
of  $\text{O}_2 \equiv 0.1$  mg of  $\text{O}_2$ .

So, 1 ml N/80  $\text{Na}_2\text{S}_2\text{O}_3$  neutralises 0.1 mg of  $\text{O}_2$ .

3.5 ml N/80  $\text{Na}_2\text{S}_2\text{O}_3$  neutralises =  $0.1 \times 3.5$  mg of  $\text{O}_2 = 0.35$  mg of  $\text{O}_2$ .

50 ml sample water contain 0.35 mg of  $\text{O}_2$

1 ml sample water contain =  $0.35/50$  mg of  $\text{O}_2$

1000 ml sample water contain =  $0.35 \times 1000 / 50$  mg of  $\text{O}_2 = 7$  mg of  $\text{O}_2$ .

So, the dissolved oxygen in pond water is 7 mg/ litre.

**Acknowledgements**

Author is thankful to Dr. Asim Kumar Ghosh, senior scientist, Bhabha Atomic Research Centre, Mumbai for his help in preparing the manuscript in present format. Author is also grateful to UGC for financial support by granting a Major Research Project.

**REFERENCES**

- APHA-2005. Standard Methods for the Examination of Water and Wastewater, 21<sup>st</sup> Edition, ISBN 0-87553-047-8.  
Winkler, L.W. 1888. Die Bestimmung des in Wasser gelösten Sauerstoffes. Berichte der Deutschen Chemischen Gesellschaft, 21: 2843–2855.

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