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The shelf life study of 0.1 M Sodium hydroxide volumetric solution at different condition for analytical purpose in Laboratory

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ABSTRACT

The expiry date of 0.1 M Sodium hydroxide volumetric solution is determined for analytical purpose in Laboratory and the Strength of Volumetric solutions determined by titration against potassium hydrogen Phthalate (KHP). The volumetric solution prepared in distilled water observed that chemically no significant degradation for at least 30 days . when solution stored in Normal and dark condition over a period of 30 days . The RSD of Molarity at Normal condition observed from 0.0993 to 0.0994 % and at Dark condition from 0.0994 to 0.2988 %. The Significant degradation observed when solution stored separately in oven at 35 °C temperature and strength of volumetric solution deviate from 18 th day . The degradation of solution strength found to 0. 98 % after storage for 30 days at 35 °C temperature.

Keywords: Shelf life, Stability, Titrimetric, Primary standard, Hold time study, Degradation.

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INTRODUCTION

The shelf life defined as the date at which the chemical solution not stable for a specific analytical use . The stability requirement for volumetric solution need to careful control of expiration date. The use of expired chemical solutions may change the results of analysis. The determination of the expiration date of a solution is related with its stability which is an intrinsic property. When storage bottle is opened the solution is exposed to various external influences which may change its integrity for a specific use. Due to basic behavior of Sodium hydroxide it can easily reacts with carbon dioxide which present in the atmosphere. Temperature, light and storage condition of bottle can also affect the physical appearance and strength of the chemical solution. The amount of chemical substances in solution is determined by Titrimetric and Gravimetric analysis. In Titrimetric analysis only volume is measured while in gravimetric analysis volumes as well as mass both are measured . In volumetric analysis reagent of known concentration added from a burette to a sample until a reaction between the two liquids is completed. This end point is usually observed in a manual titration by physical change. Indicators are reagent to determine the specified end point in a chemical reaction to measure hydrogen-ion Concentration (pH). The point at which reaction is completed is called equivalent point or stoichiometric end point. The standardization of volumetric solution starts on same day i,e after first day (initial) ,6th, 12th, 18th, 24th and 30th day. The main aim of the present work to evaluate the shelf life of 0.1 M NaOH volumetric solutions in laboratories for the purpose of quantitative analysis.

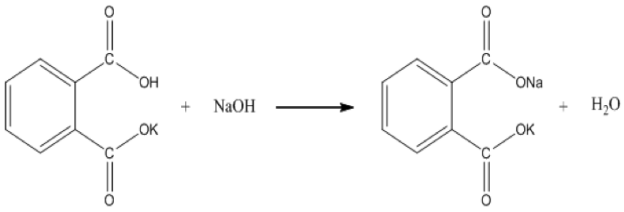

Figure 1. The reaction between potassium hydrogen phthalate and sodium hydroxide to give Sodium potassium phthalate and water.

Experimental

Reagents and Chemicals: Phenolphthalein, Sodium hydroxide and Potassium hydrogen phthalate were commercially purchased and used .

Methods of preperation: Dissolve 4.2 gm of sodium hydroxide in sufficient carbon dioxide free water to produce 1000 ml.

Procedure to standarization:

Weigh accurately 500 mg of potassium hydrogen phthalate previously dried at 120 °C for 2 hours and dissolve in 75 ml of carbon dioxide free purified water . Add 0.1 ml of phenolphthalein solution and titrate with 0. 1M sodium hydroxide until a permanent pink colour is produced. Perform the titration in triplicate (for Set- I,II and III).

1 ml of 0.1 M Sodium Hydroxide is equivalent to 20.42 of potassium hydrogen phthalate

Calculation of Molarity

$$= \frac{\text{Weight of potassium hydrogen phthalate (mg) X 0.1 X Potency}}{\text{20.42 X Volume consumed of 0.1 M Sodium Hydroxide X 100}}$$

To perform present experiment only calibrated glassware and Analytical grade reagents were used. The bottles of Volumetric solution stored at different condition. All analytical works based on the procedure of Good laboratory Practice (GLP).

RESULT AND DISCUSSION

Volumetric solutions standardized by titration against potassium hydrogen phthalate (KHP) which is a primary standard. A sets of three volumetric solutions of unique ID.No. prepared for Validity study and differentiate these by assigning No.VS-1/3,VS-2/3,VS-3/3. All three Volumetric solution standardized in triplicate set and % RSD should not be more than 0.50%. To establish expiry date of volumetric solutions Hold Time study analysis is performed from day 1 to day 30. The Physical appearance and Strength of volumetric solution are observed at different interval till 30 days. The standardation of all three volumetric solutions has been done on specified frequency i,e first day (initial), 6th, 12th, 18th, 24th and 30th day. Trend data analysis of volumetric solution mentioned in Table 1 and Table 2 shows that the strength of 0.1 M NaOH Volumetric solution is stable over a period of 30 days at Normal and Dark condition. There is no appearance of colour change and sedimentation of volumetric solution during 30 days validity study at Normal and Dark condition. The % RSD of Molarity at Normal condition observed from 0.0993 to 0.0994 % and at Dark condition from 0.0994 to 0.2988 %. However Trend data analysis of volumetric solution which stored at 35 °C mentioned in Table 3 shows that strength of volumetric solution deviate from 18 th day indicating % RSD exceed the maximum limit of 0.5 % acceptance criteria. The % RSD on 18 th Day is 1.5060, on 24 th day is 1.8109 and on 30 th day is 2.1191 . Figure 3 also shows that continuous decrease to strength of volumetric solution from initial to 30 days. The degradation of solution strength observed 0. 98 % after storage for 30 days at 35 °C Temperature. The expiration date of volumetric solution was established on the basis of acceptance limit of RSD not more than 0.5 % and taking into consideration of Good laboratory practice (GLP).

Table 1: Trend Data Analysis (When Volumetric Solution stored at Normal Condition)

Day	Normality		Average	RSD for Set 01,02,03	RSD for days (at different interval)
1st day(Initial)	Set-01	0.1004	0.1006	0.1988	Initial
	Set-02	0.1006			
	Set-03	0.1008			
6 th Day	Set-01	0.1005	0.1007	0.1986	0.0993
	Set-02	0.1007			
	Set-03	0.1009			
12 th Day	Set-01	0.1008	0.1008	0.0992	0.0993
	Set-02	0.1007			
	Set-03	0.1009			
18 th Day	Set-01	0.1007	0.1005	0.2985	0.0994
	Set-02	0.1002			
	Set-03	0.1006			
24 th Day	Set-01	0.1006	0.1007	0.1986	0.0993
	Set-02	0.1005			
	Set-03	0.1009			
30 th Day	Set-01	0.1005	0.1005	0.1990	0.0994
	Set-02	0.1003			
	Set-03	0.1006			

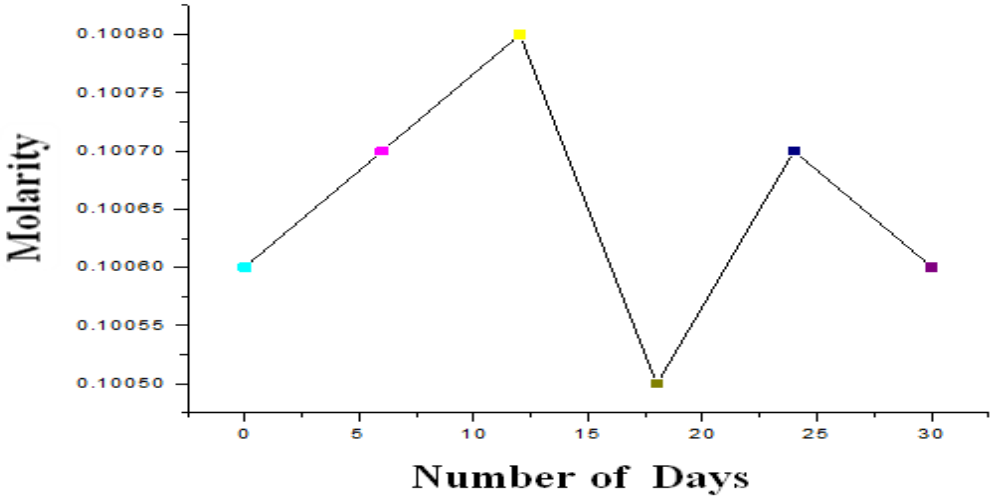

Figure 2: Graph plotted between Molarity and Number of days (Solution stored at Normal Condition)

Table 2: Trend Data Analysis (When Volumetric Solution stored at Dark Place)

Day	Normality		Average	RSD for Set 01,02,03	RSD for days (at different interval)
1st day(Initial)	Set-01	0.1004	0.1006	0.1988	Initial
	Set-02	0.1006			
	Set-03	0.1008			
6 th Day	Set-01	0.1002	0.1003	0.1994	0.1990
	Set-02	0.1001			
	Set-03	0.1005			
12 th Day	Set-01	0.1005	0.1004	0.1992	0.0995
	Set-02	0.1004			
	Set-03	0.1002			
18 th Day	Set-01	0.1004	0.1005	0.1990	0.0994
	Set-02	0.1007			
	Set-03	0.1004			
24 th Day	Set-01	0.1004	0.1004	0.1992	0.0995
	Set-02	0.1002			
	Set-03	0.1005			
30 th Day	Set-01	0.1003	0.1002	0.0998	0.2988
	Set-02	0.1001			
	Set-03	0.1002			

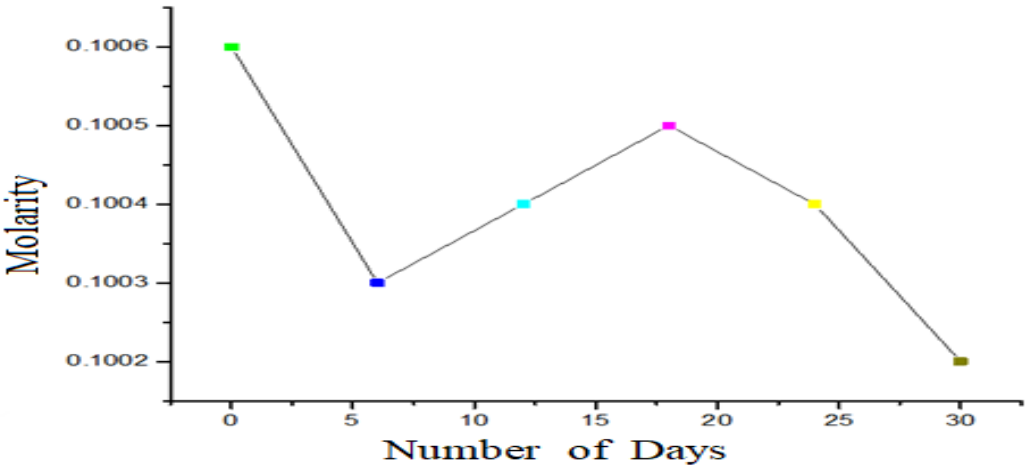

Figure 3: Graph plotted between Molarity and Number of days (Solution stored at Dark Place)

Table 3: Trend Data Analysis (When Volumetric Solution stored at 35 °C)

Day	Normality		Average	RSD for Set 01,02,03	RSD for days (at different interval)
1st day(Initial)	Set-01	0.1004	0.1006	0.1988	Initial
	Set-02	0.1006			
	Set-03	0.1008			
6 th Day	Set-01	0.1002	0.1004	0.1992	0.0995
	Set-02	0.1004			
	Set-03	0.1005			
12 th Day	Set-01	0.1002	0.1001	0.1998	0.3984
	Set-02	0.1001			
	Set-03	0.0999			
18 th Day	Set-01	0.0985	0.0985	0.2030	1.5060
	Set-02	0.0986			
	Set-03	0.0983			
24 th Day	Set-01	0.0983	0.0981	0.6116	1.8109
	Set-02	0.0986			
	Set-03	0.0975			
30 th Day	Set-01	0.0981	0.0976	0.5123	2.1191
	Set-02	0.0975			
	Set-03	0.0972			

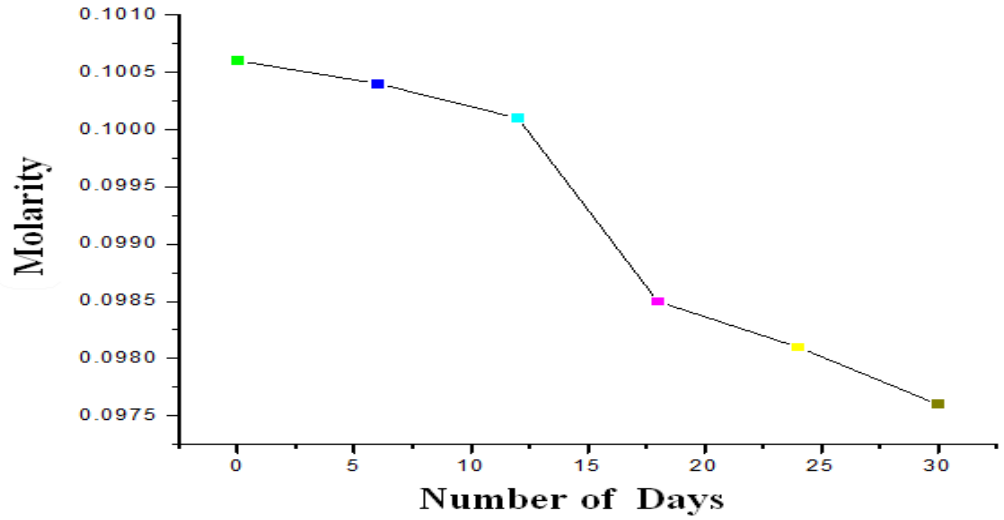

Figure 4: Graph plotted between Molarity and Number of days (Solution stored at 35 °C).

CONCLUSIONS:

The method used to determined the strength of 0.1 M Sodium Hydroxide volumetric solution at different condition (Normal, Dark and 35 °C) is easy to perform and accurate. The reagent used to determine strength of volumetric solution is potassium hydrogen phthalate. The % RSD of Molarity at Normal condition found from 0.0993 to 0.0994 % and at Dark condition from 0.0994 to 0.2988 %, which compiles the RSD acceptance limit of 0.5%.The strength of volumetric solution deviate from 18 th day at 35 °C temperature ,% RSD on 18 th day is 1.5060, on 24 th day is 1.8109 and on 30 th day is 2.1191, which does not complies the RSD acceptance limit of 0.5% . From these results of Molarity at different storage condition it is concluded that validity of 0.1 M Sodium Hydroxide volumetric solution is one month from the date of preparation at Normal and Dark condition.

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