LAB 0: GOOD LABORATORY PRACTICES EXERCISE

OBJECTIVE

a) to prepare a *stock* and *standard* solution by volumetric dilution and

b) to standardize a solution of unknown concentration using the standard solution.

EXPERIMENTAL PROCEDURE

An accurately weighed quantity of sulfamic acid (a primary standard) is provided in a 100 mL volumetric flask. Prepare your stock solution of sulfamic acid (HSO_3NH_2) by diluting this solid to the 100.00 mL mark with deionized water. Ensure complete mixing of this solution with a minimum of 15-20 inversions. Using the mass information provided on the flask, determine the molarity of stock sulfamic acid (Molar Mass of HSO_3NH_2 = 97.10 g/mol).

Mass of sulfamic acid supplied = 4.782 g

$$[HSO_3NH_2]_{Stock} = \frac{\#mols}{Volume} = \frac{4.782\,g \times \frac{1\,mol}{97.10\,g}}{0.10000\,L} = 0.492\bar{4}82\ \frac{mol}{L}$$

$$= 0.4924_{82}\ \frac{mol}{L}$$

Next, prepare a ~0.1M standard solution of sulfamic acid by diluting the appropriate volume of stock solution with deionized water in another 100 mL volumetric flask. Note: the final concentration should be known as precisely as possible (it is a standard solution), but need not be exactly 0.1000M (i.e., 0.09981 M or 0.1022 M are completely acceptable values).

Glassware used: 20.00 mL pipet & 100.0 mL volumetric flask

$$[HSO_3NH_2]_{Standard} = [HSO_3NH_2]_{stock} \cdot \frac{V_i \leftarrow 20.00\,mL}{V_f \leftarrow 100.0\,mL}$$

$$= 0.098\bar{4}964\ \frac{mol}{L}$$

$$= 9.84_{964} \times 10^{-2}\ \frac{mol}{L}$$

Finally, *standardize* the unknown sodium hydroxide solution provided by titrating a 25 mL aliquot of standard sulfamic acid with the NaOH solution. Use 3 drops of indicator solution (phenolphthalein) to visualize the endpoint of the titration by the appearance of a persistent light pink color. The stoichiometry of the reaction is:

$$NaOH\ (aq) + HSO_3NH_2\ (aq) \rightarrow NaSO_3NH_2\ (aq) + H_2O\ (l)$$

Table 1: Example Titration Data for the Standardization of NaOH

Trial	Initial Volume (+/- 0.02 mL)	Final Volume (+/- 0.02 mL)	Volume Transferred (±0.03 mL)
1	0.12	25.78	25.66
2	10.08	35.66	25.58
3	7.34	33.02	25.68
4	1.98	27.50	25.52

mean = 25.61 mL
stdev = 0.074 mL
rsd = 0.29%

Titration of 25.00 mL of a sulfamic acid primary standard using a phenolphthalein end-point
[HSO3NH2] = 0.0984964 M

Calculate the concentration of NaOH for each titration above.

$$[NaOH] = \frac{\#mols\ HSO_3NH_2 \times \frac{1\ mol\ NaOH}{1\ mol\ HSO_3NH_2}}{Volume\ NaOH\ in\ titration} = \frac{9.84964 \times 10^{-2}\ M \cdot 25.00 \times 10^{-3}\ L}{25.61 \times 10^{-3}\ L}$$

$$= 9.61503\ \cancel{mol}/L \times 10^{-2}\ \frac{mol}{L}$$

Table 2: Results for the Standardization of NaOH

Trial	[NaOH] (M)	Mean (M)	StDev (M)	RSD (%)	
1	0.095963	0.0961503	2.8×10^{-4}	0.29	
2	0.096263				
3	0.095888				
4	0.096489				

Calculated from Data in Table 1

Concentration of NaOH used in subsequent calculations =

$$(9.61503 \pm 0.00028) \times 10^{-2}\ M$$

How do these results compare to 2012 class data?