جامعة الانبار

كلية : الصيدلة

قسم : الكيمياء الصيدلانية

اسم المادة باللغة العربية: الكيمياء التحليلية

اسم المادة باللغة الإنكليزية: **Analytical Chemistry**

المرحلة: الأولى

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عنوان المحاضرة باللغة العربية: الكيمياء التحليلية العملي التجربة الرابعة

عنوان المحاضرة باللغة الإنكليزية: **Practical Analytical Chemistry (4)**

Exp. 4

Analysis of Sodium Carbonate and Sodium Hydroxide Mixture

The analysis of bases mixture is analogous to that for acids. A standard acid solution is used as titrant. The analysis of such mixtures requires two titrations with standard acid. An indicator with a transition in the vicinity of pH 8 to 9 is used for one; an acid-range indicator is used for the other. The composition of the solution can be deduced from the relative volume of acid needed to titrate equal volumes of the sample. Once the composition has been established, the volume data can be used to establish the concentration of each component in the sample.

Sodium carbonate reacts with HCl according to the equation:

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$$

So to neutralize all the carbonate we need two equivalents from the acid. But when we add one equivalent from the acid to the sodium carbonate, it converts to bicarbonate according to the equation:

$$Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl$$

The pH of the solution changes from 11.5 to 8.3, so if we use the ph.ph indicator, its red color changes to colorless by the end of this step, because the change in the pH during this step lies in the same range that the color of the indicator changes (8.3 – 10).

If we use methyl orange indicator, the carbonate reacts totally and needs two equivalents from the acid. The bicarbonate converts to sodium chloride according to the equation:

$$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$$

The pH of the solution changes from (8.3 – 3.8), which is nearly the same range of methyl orange range.

Sodium hydroxide reacts with the HCl according to the equation:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

That is mean one equivalent from the acid is needed to neutralize the hydroxide.

Procedure

Prepare 0.1N from HCl, and full the buret with it. Transfer by a pipette 10 ml from the bases mixture in 250 ml conical flask and introduce 2 drops of ph. Ph indicator. Titrate until the solution just changes from pink to colorless, and write down the volume of the acid. The volume of the acid here (v_1) is equivalent to the all hydroxide and 1/2 the carbonate.

Ph.ph

$$Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl$$

Add 2 drops of the methyl orange indicator and continue the titration until the solution just change from orange to red. (It is possible to empty the conical flask and take 10 ml of the mixture and 2 drops of M.O. and start from the beginning). The volume of the acid here (v_2) (which is equal to v_1 and the added volume of the acid), is equivalent to the all hydroxide and all the carbonate.

M.O.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

M.O.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2CO_3$$

$v_2 - v_1 = v_3$ is the volume of the acid equivalent to 1/2 carbonate

$v_3 \times 2$ is the volume of the acid equivalent to all carbonate

$v_2 - 2v_3 = v_4$ is the volume of the acid equivalent to all hydroxide

no. of the acid milliequivalents = no. of the carbonate milliequivalents

$$N_1 \times V_1 = N_2 \times V_2$$

$$0.1 \times 2v_3 = N_2 \times 10$$

N_2 = normality of carbonate

The strength of carbonate solution g/L = $N_2 \times$ equivalent weight (molecular wt./2)

no. of the acid milliequivalents = no. of the hydroxide milliequivalents

$$N_1 \times V_1 = N_2 \times V_2$$

$$0.1 \times v_4 = N_2 \times 10$$

N_2 = normality of hydroxide

The strength of hydroxide solution g/L $= N_2 \times$ equivalent weight (molecular wt./1)