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A novel online coupling of ion selective electrode with the flow injection system for the determination of vitamin B₁

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Abstract:

A simple, fast, selective of a new flow injection analysis method coupled with potentiometric detection was used to determine vitamin B₁ in pharmaceutical formulations via the prepared new selective membranes. Two electrodes were constructed for the determination of vitamin B₁ based on the ion-pair vitamin B₁-phosphotungestic acid (B₁-PTA) in a poly (vinyl chloride) supported with a plasticized di-butyl phthalate (DBPH) and di-butyl phosphate (DBP). Applications of these ion selective electrodes for the determination of vitamin B₁ in the pharmaceutical preparations for batch and flow injection systems were described. The ion selective membrane exhibited a near-Nernstian slope values 56.88 and 58.53 mV / decade, with the linear dynamic range of vitamin B₁ was 5×10^{-5} - 1×10^{-2} and 1×10^{-4} - 1×10^{-2} mol.L⁻¹, in batch and FIA, respectively. The limit of detection was 3.5×10^{-5} and 9.5×10^{-5} mol.L⁻¹, with the percentage linearity 98.85 and 95.22 in batch and FIA, respectively. The suggested ion selective electrode has been utilized perfection in the determination of vitamin B₁ in pharmaceutical formulations using batch and flow injection system, respectively.

Key words: Flow injection analysis; ion selective electrode; vitaminB₁ determination; pharmaceutical preparation.

Introduction

Vitamin B₁, also known as thiamine hydrochloride is {3-[(4-Amino-2-methylpyrimidin-5-yl)methyl]-5-(2-hydroxyethyl)-4-methylthiazolium chloride hydrochloride} (Figure 1) [1]. A deficiency of this vitamin B₁ causes many diseases in adults and children with high intake of white rice or food containing anti-thiamine factors, e.g.

beriberi [2], and epilepsy [3]. Many of analytical methods are available for the determination of vitamin B₁ either alone or in conjunction with various drugs in pharmaceutical formulations and biological fluids using calorimetric [4], spectrophotometry [5-7], electrochemistry [8], fluorimetric [9], chromatography [10-15], chemiluminescence [16].

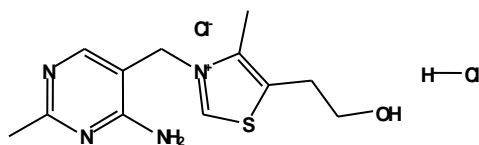


Fig.(1): The chemical structure of vitamin B₁ [1].

Potentiometric methods are more productive in innovations in view of the more possibilities for the design of the electrodes that can easily be converted into flow-through electrodes via passed in the flow cell. Consequently, the focus of this work includes two points. Firstly, is a building up a new online multi semi-automated system that is capable to determine pharmaceuticals preparations which depends on the use of selective membranes and the possibility of this system for measuring one of these pharmaceuticals, or group of pharmaceuticals in the mixture by selectively choosing the kind of the mode. Secondly, new ion selective membranes for vitamin B₁ based on ion-pair of vitamin B₁ with PTA were prepared using DBPH and DBP as plasticizers.

Material and methods:

Reagents and materials

The thiamine hydrochloride standard (C₁₂H₁₇ClN₄OS.HCl) was obtained from Samara drug industry. The pharmaceutical formulations samavit (tablet) and thiamine injection (ampoule) were supplied by Samira-Iraq and Beijig-china companies, respectively. Phosphotungestic acid was obtained from Merck. Di-butylphthalate (C₁₆H₂₂O₄) was supplied by Ferak. Di-butylphosphate (C₈H₁₉O₄P), poly vinyl chloride (PVC) (CH₂-CHCl)_n with high molecular weight, tetrahydrofuran (C₄H₈O), hydrochloric acid and Fe₂(SO₄)₃.5H₂O were supplied by Fluka.

Sodium carbonate, potassium chloride, acetic acid, sodium acetate trihydrated, disodium hydrogen phosphate, LiCl, CaCl₂, MgCl₂.6H₂O, Al₂(SO₄)₃.16H₂O and CrCl₃.6H₂O were purchased from BDH. NaCl was obtained from Fisher scientific. ZnCl₂ was obtained from Flucka AG. All chemical solutions used in this work were prepared from distilled water.

Apparatus

Complementary parts in batch-system

Microprocessor based Bench pH/MV/C Meter (model pH211, HANNA instruments (Romania)) was used to measure the potentiometric signals. Calomel reference (USA) and silver-silver chloride (Ag/AgCl) electrodes were used as external reference and an internal reference, respectively. Portable pH/ORP Meter (model HI 9125, HANNA instruments (USA)) was used for adjusting pH of solutions. UV/VIS spectrophotometer model SP-3000 plus, Optima INC, (Japan) was used for dispersion calculations.

Complementary parts in flow-system

A new flow injection system was consisted of peristaltic pump (model Gilson 72Rue Gambetta B.P. 45 (France)), and used with one line. An injection valve was used to inject sample volume in the carrier stream (distilled water line). Silicon rubber and Teflon tubing used for connecting tubes (I.D: 0.5, 0.7, 1 mm). Four Teflon electrodes (homemade) have been utilized. Flow cell (homemade) made from poly methyl methacrylate (PMMA) used for entrapment of the Teflon electrode, and also facilitate the flow of solutions. A new electronic system (homemade) that based on field effect transistor (FET) was used to record the results. Figure 2 was represented the schematic diagram of

flow injection-ion selective electrode system.

Preparation of ion-pair

The ion-pair of B₁-PTA was synthesized by mixing 0.01 mol.L⁻¹ of vitamin B₁ with 0.01 mol.L⁻¹ of PTA. The obtained precipitated was filtered and washed with distilled water, then dried in room temperature. This ion-pair was used for synthesis of electrode membrane.

Synthesis of membrane

Two membranes were prepared by mixing an amount of ion-pair (B₁-PTA) with DBP or DBPH and PVC which dissolved in 8-10 mL of THF. The membrane was cut equal to the external diameter at the edge end of the electrode. These membranes were used as sensors for the determination of vitamin B₁. It is worth to be mentioned the membrane was immersed in standard of vitamin B₁ in 2 hours before using for measurements.

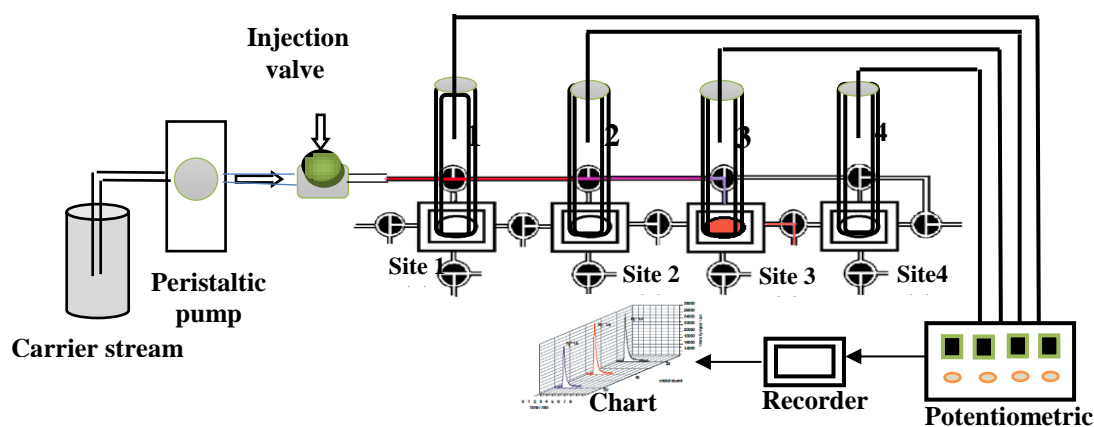


Fig. (2): Flow injection-ion selective electrode system.

Construction of calibration curve

In batch mode, the concentrations range of vitamin B₁ were prepared from 1×10⁻⁶ to 1×10⁻² mol.L⁻¹ and recorded the measurements potential for each concentration, then plotted between potential and concentration. In FIA mode, range of concentrations 1×10⁻⁶ to 1×10⁻² mol.L⁻¹ of vitamin B₁ was injected to the flow system under optimum conditions from flow rate and volume injection (using the third site in new flow injection for this research). The obtained peak heights were recorded and used to plot the calibration curve.

Potentiometric analysis for determination of vitamin B₁

Direct method was consisted of the measured response for sample solution

and read the concentration from the calibration graph that prepared from vitamin B₁ standard solutions. In the standard addition method, 0.1 mL of vitamin B₁ standard solution (0.01) was added to 50 mL of the same sample pure or pharmaceutical formulations. The change in electrode response was recorded and used to calculate the concentration of sample by following Equation:

$$C_U = C_S / 10^{\Delta E/S} [1 + V_U/V_S] - (V_U/V_S) \quad (1)$$

Where C_U, C_S the concentration of unknown and standard solution, respectively, V_U, V_S are the volume of unknown and standard solution, respectively, S: the slope of electrode, ΔE: the potential difference [17].

Table (1): Representative statistical results for the determination of vitamin B₁ in batch mode*.

Plasticizers	DBP	DBPH
Linearity (mol.L ⁻¹)	$1 \times 10^{-4} - 1 \times 10^{-2}$	$5 \times 10^{-5} - 1 \times 10^{-2}$
Confidence interval of the slope (b \pm ts _b)	46.44 \pm 2.98	56.88 \pm 9.99
Confidence interval of the intercept (a \pm ts _a)	175.91 \pm 8.98	201.74 \pm 3.06
Corr. coef. (r)	0.9938	0.9942
%Linearity (R ²)	98.77	98.85
**t-test Tabulated two tailed (n-2) 95% C.I	3.182	2.776
**t-test calculated	15.52	18.54
Detection limit (mol.L ⁻¹)	7.0×10^{-5}	3.5×10^{-5}

**If the assumption was made. Null Hypothesis H₀: $\rho=0$ (no correlation- non linear). Alternative Hypothesis A: $\rho \neq 0$ (significant correlation- significant linear). It can be seen that the calculated practically found value of t is larger than the critical tabulated value at 95% confidence interval $|t| > t_{\alpha/2} (n-2)$ therefore H₀ is rejected against A. i.e linearity is accepted for the range given.* n=3.

Results and Discussion:

Optimization of ISE response in batch condition

Influence of plasticizers on the electrode response

Two plasticizers DBPH and DBP were investigated (Table 1). Table 1 exhibits that DBPH is the best of the plasticizers examined due to high mixing between plasticizer and PVC that leads to production of homogeneous membrane. Therefore DBPH plasticizer gave near-Nernstian response. While DBP shows the poor sensitivities on the electrode response. The reason for this must be to high viscosity of the plasticizer which decreases the ion-exchange process.

Influence of pH

The effect of pH of the vitamin B₁ solution (1×10^{-3} , 1×10^{-4}) mol.L⁻¹ on B₁-PTA electrode and DBPH plasticizer was studied by adding dilute solution of hydrochloric acid (0.1 mol.L⁻¹) and sodium hydroxide (0.1 mol.L⁻¹). Figure 3 illustrates the B₁-PTA electrode can be used in the pH range of 4-7 with good sensitivity.

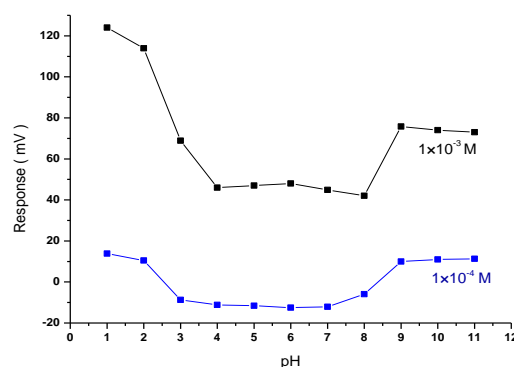


Fig. (3): The effect of pH on the B₁-PTA electrode response.

It should be noted increasing pH (pH >8) leads to decrease electrode response due to that vitamin B₁ was insoluble in basic solution. The electrode response increases in strong acid (pH < 3) solution. This indicates that ion-pair (B₁-PTA) might probably respond to hydrogen ions.

Response time

The response time was measured for the vitamin B₁ electrode based on DBPH for two concentrations (1×10^{-2} , 1×10^{-5}) mol.L⁻¹ as shown in the Figure 4. The values of response time increase as the concentration decrease. This is attributed to the need for more time to reach the equilibrium between the ion-

pair in the membrane and the external solution when the concentration of external solution is too low.

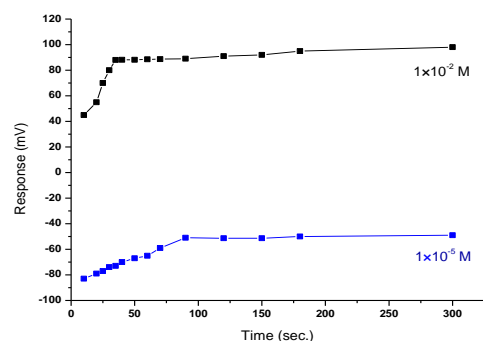


Fig. (4): The effect time on the B₁-PTA electrode response.

Lifetime of the electrode

The lifetime of the B₁-PTA electrode was investigated by accomplishing calibration curve (Figure 5) as a function of immersing time. The results show that the slope of the calibration curve was 56.89 mV decade⁻¹ after one week immersing in 1×10⁻² mol.L⁻¹, then the slope decreased, reaching 56.49, 53.62, 50.59 and 45.46 mV decade⁻¹ after 3, 5, 6, 7 weeks, respectively. Theoretically, the lifetime of this electrode is terminated in the fifth week of soaking, but practically, the electrode is fit for the use on the lower slope value. After this time, the electrode becomes less sensitive toward vitamin B₁, which may be due to gradual leach of the ion-pair from the membranes to the external solution.

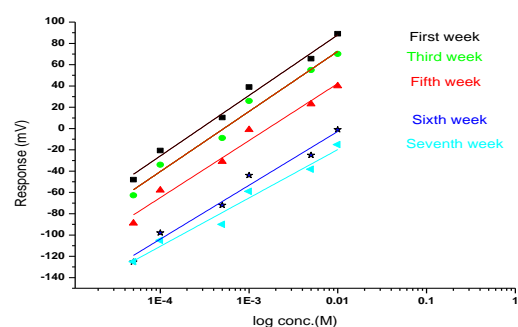


Fig. (5): Immersing time effect on the B₁-PTA electrode.

FIA conditions

A new manifold system consists of four sites of the flow system. Each site contains one electrode, and each electrode with drug membrane that is different from the other electrode. The flow measurements were accomplished in a one line system, the analyte is injected via the injection valves passes through the pump to the sites of each of the four electrodes. In this research, vitamin B₁ electrode that in the third site was studied. The dispersion effect and site effect on vitamin B₁ electrode response were studied. The dispersion of the third site is equal 2.13.

Influence of flow rate

This factor was studied by varying flow rates (0.54-2.04) mL.min⁻¹ at constant injection volume equal 1 mL and vitamin B₁ concentration (1×10⁻³) mol L⁻¹. The results of variations of the flow rate show that increasing the flow rate leads to an increase in response. The effect of flow rate on width base (Δt_B) was also studied. In the low flow rate, the travelled distance of the sample increases because of the dispersion in sample segment and the long distance between the site of the electrode and the injection point. While in the high flow rate, the travelled distance of the sample is decreased, due to fast entry and departure from the site as shown in

Figure 6. The flow rate of $2.04 \text{ mL}\cdot\text{min}^{-1}$ was selected as the optimum flow rate for this site.

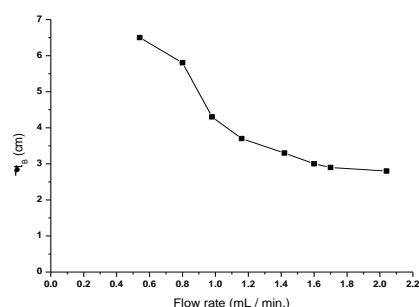


Fig. (6): The effect of flow rate on the travelled distance for the sample segment.

Influence of injection volume

The variations of the sample volumes (0.5-2.5 mL) were injected of vitamin B₁ ($1 \times 10^{-3} \text{ mol}\cdot\text{L}^{-1}$) at a constant flow rate of $2.04 \text{ mL}\cdot\text{min}^{-1}$. It should be noted that the large volume of vitamin B₁ is injected leads to an increase in response and dispersion (irregular response, broad signal) as shown in Figure 7. In addition the increased sample volume will consume large amount of the vitamin B₁.

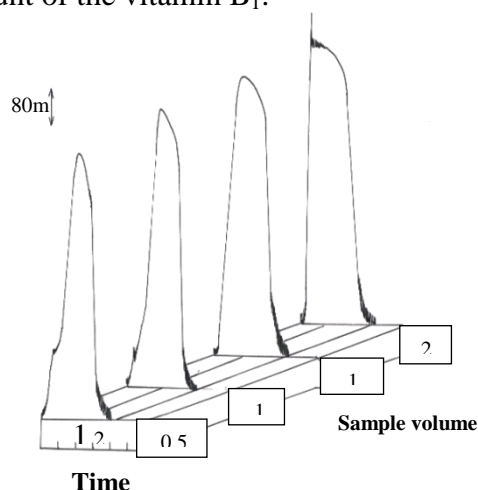


Fig. (7): Response-time-sample volume profile of vitamin B₁.

At the low injected sample volume of vitamin B₁ leads to low response. The influence of the sample volume effect on Δt_B was studied. Increasing the

injected volume leads to an increase of the travelled distance that causes the dispersion in sample segment (irregular response, broad signal). At low injecting volumes of drug leads to low response. Therefore the injected volume of 1 mL was chosen as the best sample volume with better response.

Influence of buffer pH

The effect of buffer on the vitamin B₁-PTA electrode was studied in the range of pH 1-9 using hydrochloride acid/potassium chloride buffer (pH=1-2), sodium acetate/acetic acid buffer (pH=3-6) and disodium hydrogen phosphate/ hydrochloride acid (pH=7-9) [18-19] at (1×10^{-3} and 1×10^{-4}) $\text{mol}\cdot\text{L}^{-1}$ of vitamin B₁, $2.04 \text{ mL}\cdot\text{min}^{-1}$ of flow rate and 1 mL sample volume as shown in the Figure 8.

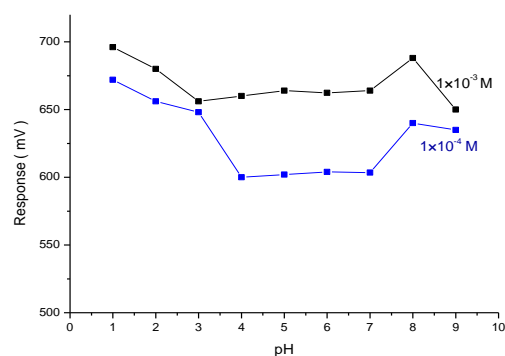


Fig. (8): The effect of buffer pH on the response of the B₁-PTA electrode.

It observed that there are no significant changes in potential in the pH range of 4 to 7, indicating that the electrode works in this range. At low pH values the response of the electrode can be noticed that it increases with lower values of pH. At the higher pH value the electrode might be poisoned, giving the irregular responses due to the precipitation of the vitamin B₁.

Calibration curve

The performance characteristics are, slope 58.53mV/decade with a linear range (1×10^{-4} – 1×10^{-2}) mol.L⁻¹ and detection limit 9.5×10^{-5} mol.L⁻¹ at the optimum conditions (flow rate 2.04 mL.min⁻¹, volume injection 1 mL and a carrier stream of buffer solution (pH 6)) were studied in the third site of the manifold system (Table 2). Figure (9) shows the calibration curve for vitamin B₁ electrode.

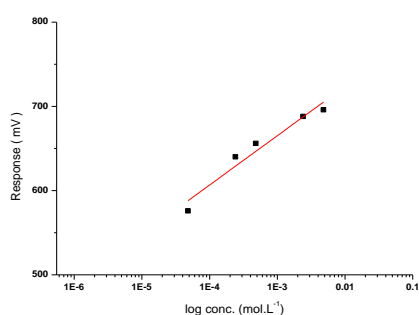


Fig. 9: Calibration curve for vitamin B₁ electrode.

Interfering ions effect

The influence of some inorganic cations on vitamin B₁ electrode was studied. The selectivity coefficients were measured using a separate solution method as Equation 2 (Nicolosky-Eisenman Equation) [20].

$$\text{Log}K_{A,B} = (E_A - E_B) / S + \log[\text{vit. B}_1] \log[B^{z+}]^{1/z} \quad (2)$$

E_A , E_B the potential of vitamin B₁ solution and interfering ion, respectively. S , represented slope of the calibration curve. In a new manifold system, the B₁ electrode was located in the third site of the flow system with optimal conditions of 2.04 mL/min of flow rate and 1mL sample volume. The response height was measured by separate solution method for the concentrations range of 1×10^{-2} to 1×10^{-6} mol.L⁻¹ of vitamin B₁ solutions in

presence of cations solutions, the potentiometric selectivity coefficient were calculated via the use of Equation 2. Selectivity coefficients results are listed in the Table 3. It was noticed from Table 3, the selectivity coefficient values for monovalent cations is higher than the values for di and trivalent cations interferences, which might be due to differences in ionic size, mobility and permeability, so that the monovalent ion interfere with the electrode response more than the di and trivalent cations.

Table (2): Representative statistical results for the determination of vitamin B₁ in FIA mode*.

Parameter	Value
Regression equation	$y = 25.41 * \ln[x] + 840.77$
Linearity (mol.L ⁻¹)	$1 \times 10^{-4} - 1 \times 10^{-2}$
Confidence interval of the slope ($b \pm t_{s_b}$)	58.53 ± 7.58
Confidence interval of the intercept ($a \pm t_{s_a}$)	840.77 ± 25.14
Corr. coef. (r)	0.9758
% Linearity (% r ²)	95.22
**t-test Tabulated two tailed (n-2) 95 % C.I	3.182
**t-test calculated	7.7305
Detection limit (mol.L ⁻¹)	9.5×10^{-5}

**If the: assumption was made. Null Hypothesis H_0 : $\rho=0$ (no correlation- non linear). Alternative Hypothesis A: $\rho \neq 0$ (significant correlation-significant linear). It can be seen that the calculated practically found value of t is larger than the critical tabulated value at 95% confidence interval $|t| > t_{\alpha/2}$ (n-2) therefore H_0 is rejected against A. i.e linearity is accepted for the range given. *n=3

Table (3): Selectivity coefficient for the vitamin B₁ electrode in batch and FIA conditions.

Interferent	Batch system			New manifold system		
	Concentration (mol.L ⁻¹)					
	1 × 10 ⁻²	1 × 10 ⁻³	1 × 10 ⁻⁵	1 × 10 ⁻²	1 × 10 ⁻³	1 × 10 ⁻⁵
	K _{A,B}					
Na ⁺	1.90 × 10 ⁻²	1.76 × 10 ⁻²	4.60 × 10 ⁻²	2.85 × 10 ⁻⁸	7.65 × 10 ⁻⁸	5.81 × 10 ⁻⁷
Li ⁺	4.69 × 10 ⁻³	5.12 × 10 ⁻³	6.92 × 10 ⁻²	5.17 × 10 ⁻⁸	1.83 × 10 ⁻⁷	2.07 × 10 ⁻⁶
K ⁺	9.33 × 10 ⁻²	6.10 × 10 ⁻²	6.94 × 10 ⁻²	3.62 × 10 ⁻⁸	1.91 × 10 ⁻⁷	6.53 × 10 ⁻⁶
Mg ⁺²	4.76 × 10 ⁻⁵	6.26 × 10 ⁻⁵	1.26 × 10 ⁻⁴	7.01 × 10 ⁻⁸	2.29 × 10 ⁻⁷	6.22 × 10 ⁻⁹
Ca ⁺²	6.29 × 10 ⁻⁴	1.63 × 10 ⁻⁴	2.79 × 10 ⁻⁴	4.71 × 10 ⁻⁷	6.18 × 10 ⁻⁷	7.29 × 10 ⁻⁹
Zn ⁺²	1.74 × 10 ⁻⁴	1.27 × 10 ⁻⁴	1.57 × 10 ⁻⁴	1.13 × 10 ⁻⁸	2.92 × 10 ⁻⁸	4.18 × 10 ⁻⁹
Al ⁺³	1.61 × 10 ⁻⁴	2.22 × 10 ⁻⁴	4.29 × 10 ⁻⁵	3.79 × 10 ⁻⁷	9.15 × 10 ⁻⁸	1.70 × 10 ⁻⁷
Fe ⁺³	1.62 × 10 ⁻³	6.39 × 10 ⁻⁴	4.16 × 10 ⁻⁵	1.64 × 10 ⁻⁶	4.12 × 10 ⁻⁶	9.37 × 10 ⁻⁷
Cr ⁺³	6.59 × 10 ⁻⁴	2.94 × 10 ⁻⁴	2.68 × 10 ⁻⁵	2.09 × 10 ⁻⁷	3.67 × 10 ⁻⁷	2.44 × 10 ⁻⁹

Response time effect

The response time for vitamin B₁ electrode was calculated, as the following Equation:

The response time was calculated for 1 × 10⁻³ mol.L⁻¹ vitamin B₁.

$$\frac{30cm}{1h} \varphi \frac{60min}{30cm} \varphi \frac{2min}{1cm} \varphi \frac{120sec.}{10mm} \varphi 12(sec./mm) \quad (3)$$

$$t_{0e}=0 \text{ mm} \times 12 \text{ sec./mm} = 0 \text{ sec.}$$

$$t_{1e}=1.7 \text{ mm} \times 12 \text{ sec./mm} = 20.4 \text{ sec.}$$

$$t_{2e}=15 \text{ mm} \times 12 \text{ sec./mm} = 180 \text{ sec.}$$

$$t_{m,e}=5 \text{ mm} \times 12 \text{ sec./mm} = 60 \text{ sec.}$$

Analytical application

Potentiometric techniques were applied in investigating electrode to determination of vitamin B₁ in pharmaceutical preparations samavit tablet and thiamine injection using direct and standard addition methods in batch and FIA conditions. The results were summed up in the Table 4.

Table (4): Results of pharmaceutical preparations estimation by using direct and standard addition potentiometric methods in batch and FIA system.

Parameters	Direct method			
	Batch method		FIA method	
	Samavit tablets	Thiamine injection	Samavit tablets	Thiamine injection
Taken (mol.L ⁻¹)	5 × 10 ⁻⁴	5 × 10 ⁻⁴	1 × 10 ⁻⁴	1 × 10 ⁻⁴
Found (mol.L ⁻¹)	5.03 × 10 ⁻⁴	5.27 × 10 ⁻⁴	1.053 × 10 ⁻⁴	1.024 × 10 ⁻⁴
Rec.%*	100.6	105.4	105.3	102.4
RSD%*	-8.750	5.556	0.249	0.204
Standard addition method				
Taken (mol.L ⁻¹)	1 × 10 ⁻⁴	1 × 10 ⁻⁴	1 × 10 ⁻⁴	1 × 10 ⁻⁴
Found (mol.L ⁻¹)	1.005 × 10 ⁻⁴	1.030 × 10 ⁻⁴	1.029 × 10 ⁻⁴	1.0118 × 10 ⁻⁴
Rec.%*	100.50	103.00	102.98	101.18
RSD%*	0.100	0.170	0.202	0.114

Table 4 exhibits it can be seen that the obtained results from standard addition method have good precision and accuracy compared with the direct potentiometry method. This might be due to the effect of cancelling the dilution factor while preparation of solution in the normal working procedure compared to the standard addition method and, therefore, the results in less error.

System effect of different location for vitamins B₁ electrodes at different sites in the newly developed manifold

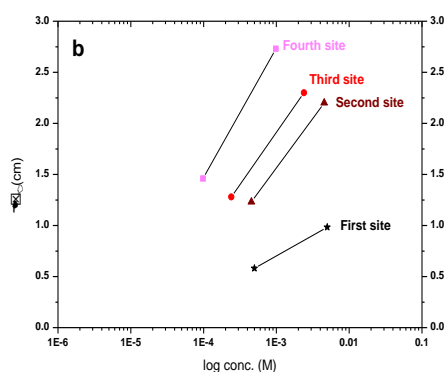
Extended experiments were conducted to establish the kind of behavior that the electrode response can act based on the design of the system in establishing all factors that might affect the whole measurements of the electrode response. The main factors that will be

studied from preliminary observation of how the system works it was concluded that peak height, Δt_B , t_0-t_1 , are the most important factors. The experiments were carried out in site one which is defined for vitamin B₁ electrode; the three factors were studied at this site; followed by transferring the electrode to the second site; where the sample passes directly to this site without passing to the first site. At this point all the three factors are studied, followed by transferring the vitamin B₁ electrode to the third site, where the sample segment passes through to this site without passing through to the first site or even to the second site. After all, the three factors were measured; the electrode was transferred to the fourth site and the sample segment when injected will pass directly to the fourth site without passing the trend of the three previous sites, all these are shown in Figures (10a, b) and (11) which indicate clearly the flow of fluid (i.e sample + carrier stream). This kind of methodology adopted here will take into account that in case of maintenance of whatever the nature is; single electrode techniques will still can proceed without difficulty

of complete stoppage. It was noticed that the obtained value represents a decrease in both 1,2 sites while there is an increase at site 4.

Fig. (10): (a): Concentrations versus average response height variation at four sites of system for vitamin B₁ electrode; (b): Variation of concentrations on the travelled distance for sample segment at four sites; taking into account dilution factor.

It can be seen from Figure (10a) related to peak height variables that there is in general a slight decrease in all responses for each replaceable electrode site compared to its original location. Comparing Δt_B values. It was noticed from Figure (10b) related to system effect study that there is as a trend of a systematic increase in Δt_B . It can be attributed to delay of the arrival sample segments to the electrode site. Relatively according to its allocation. While for arrival time i.e t_0-t_1 there is a logic increase or decrease in t_0-t_1 according to its position in the system as shown Figure 11.



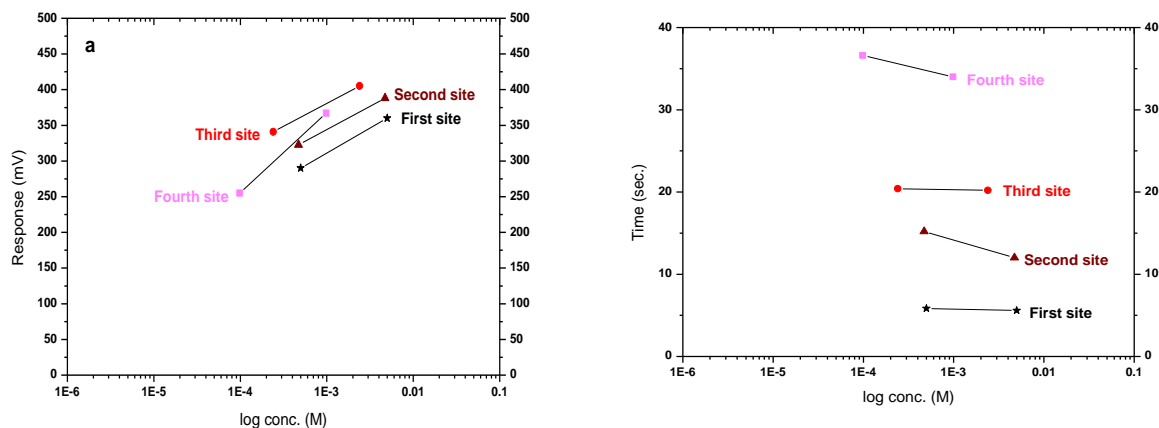


Fig. (11): Concentrations versus arrival time for a sample segment at four sites for vitamin.B₁ electrode; taking into account dilution factor.

Conclusion :

The present work demonstrates the construction of new vitamin B₁ and PVC. The construction electrodes work in a satisfactory manner in the concentration range from 5×10^{-5} to 1×10^{-2} with a good operational lifetime and the response time. The best vitamin B₁ electrode was based on DBPH. A new FIA system is simple to construct and operate was built up. The construction electrodes were successfully applied for determination vitamin B₁ in pure solution and in pharmaceutical preparations using batch and FIA. The obtained results show the propose method is simple and rapid, with good accuracy.

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منظومة مبتكرة حديثة لتقدير فيتامين ب1 باستخدام القطب الانتقائي الايوني المقترن بالحقن الجرياني

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الخلاصة:

تم أستحداث طريقة جديدة للحقن الجرياني المقترن مع كاشف فرق الجهد، لتقدير فيتامين B₁ في المستحضرات الصيدلانية من خلال تحضير اغشية انتقائية جديدة. وتم تصنيع قطبان لتقدير فيتامين B₁ بالاعتماد على المزوج الايوني فيتامين (B₁- حامض فوسفونتكستن) في متعدد (كلوريد الفينيل) كاساند مع الملدنات ثنائي بيوتيل الفثالايت وثنائي بيوتيل الفوسفات. وتم اجراء التطبيقات على هذه الاقطاب الانتقائية للنظامين التقليدي والحقن الجرياني المقترن مع كاشف فرق الجهد لتقدير فيتامين B₁ في المستحضرات الصيدلانية. ويظهر غشاء الايون الانتقائي قيم ميل قريبه لميل نرنست وهي 56.88 و 58.53 ملي فولت افترة زمينه. وفيما يخص المعطيات التحليلية الإحصائية فقد كانت خطية التركيز في تعيين B₁ (1 x 10⁻² - 5 x 10⁻⁵) مول.لتر⁻¹ للطريقة التقليديه و (1 x 10⁻² - 1 x 10⁻⁴) مول.لتر⁻¹ للطريقة المستحدثة وكان حد الكشف (3.5 x 10⁻⁵) و (9.5 x 10⁻⁵) مول.لتر⁻¹ مع نسبة خطية 95.22 و 98.85 في التقليدي والمستحدث على التوالي. وتم استخدام القطب الايون الانتقائي المقترح بشكل مثالي في تقدير فيتامين B₁ في المستحضرات باستخدام الطريقة التقليدية والمستحدثة على التوالي.

الكلمات المفتاحية: تحليل بالحقن الجرياني، قطب الانتقائي الايوني ، تقدير فيتامين ب1، المستحضرات الصيدلانية