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Clinical Applications of Uric Acid via Chemical Method using Polarography Technique Comparing with Spectrophotometric Methods

Eman A.M. AL-JAWADI
Mosul University

Haitham A.A. AL-WAHAB
Mosul University

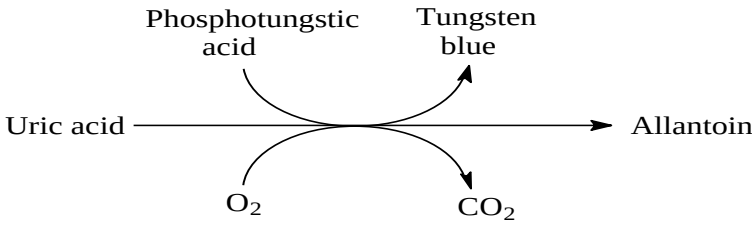
Abstract: Uric acid is considered one of the important biological compounds in the human body and one of the vital indicators for the medical diagnosis of many diseases, kidney diseases and others. The study includes determination of uric acid in urine by polarography technique and comparing the results with those obtained by the routine spectrophotometric technique , the estimation of the products from using Folin-Denis reagent as indicator to detect uric acid in patients with renal, renal failure and hypertention comparing with normal these disease cause obvious decrease in uric acid concentration in patients urine.Determination of uric acid by chemical method using polarogrphyic technique (DPP), it showed an obveous reduction current peak at potential (- 0.6155 V) .DPP technique gave better result comparing with spectrophotometric method in effort, time and cost.

Keywords: Uric acid, Polarography, Renal failure

Introduction

This method involves the use of Phosphotungstic acid, also known as the Fulin-Denis reagent, which is reduced by uric acid in the model with the base to a blue substance known as blue tungsten(Tungsten blue) .

A comprehensive study of the measurement of uric acid (mg / 24hr) was carried out in the DPP method using a chemical method based on the amount of height in the Folin-Denis reductor wave with uric acid Which may be due to the stimulation of the reduction wave guards of the detector (Enhancement) as in the following equation:



The chemical reaction of the Folin-Denis reagent, reduced by uric acid, and the presence of the base gave two clear reduction pulses, the first at a reduction voltage (-0.512) volt and the second at a reduction voltage (-0.66) volts against the calomel electrode, After a voltage of between (-0.2) - (- 0.8) volt, as shown in Figure (1).

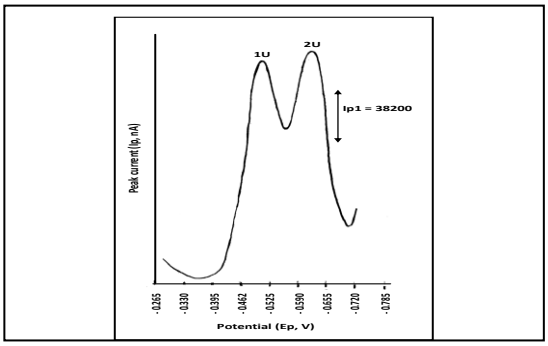


Figure 1. The folin-Denis reagent measurement parameters for the determination of uric acid in Folin-Denis reagent

Method

Method of measurement using DPP technique with lead sample:

1. 8.5 mg of pH solution (pH = 7.0) was taken in the measuring cell (clean and dry).
2. Transfer the nitrogen gas for 10 minutes after which the measurement is done for the reference (Blank).
3. Add 1 mL of the fulen-denis powder with 0.5 mL of sodium carbonate (10%), nitrogen gas (3) minutes and then measure.
4. 0.1 mL of the nitrogen and nitrogen oxides were added and re-read an hour later as the color of the solution changes to blue.

Results and Discussion

Optimization of the Conditions

The optimum conditions for the study of polarogram were determined to reduce the foiln-denis detector by the presence of uric acid by tracking the resulting reduction waveguides that gave the best value of the propagation current (Ip) and the best form of the reduction wave (Ep) by adding 8.5 milliliters of the pH solution 7.0), (1) milliliters of foiln-denis reagent and (0.5) milliliters of sodium carbonate and uric acid at a concentration of 4.97 × 10-6 molar. These conditions included:

Effect of pH

To determine the best pH number on the reduction voltage (Ep) and the propagation current (Ip) of the folin-Denis reductor reducers by uric acid, the differential pulse polarity (DPP) of the reduction products was recorded at -0.812 volts and voltage (-0.66 volts) Where the measurement range is between (6-9) for the solution of the regulated phosphate, as in Table (1) which shows the results obtained.

pH	Ep_1 (V)	Ip_1 (nA)	Ep_2 (V)	Ip_2 (nA)
6	-0.501	4250	-0.647	3800
7	-0.512	4400	-0.660	4200
8	-0.530	3200	-0.681	3700
9	-0.546	2100	-0.690	3650

PH (pH 7) was selected for this study and this value was determined and used in clinical applications as shown in Figure (2).

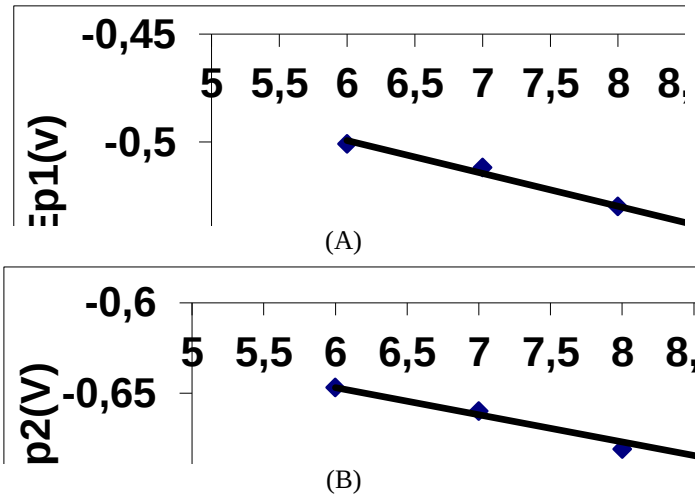


Figure 2. Shows the relationship between the voltage (Ep) and the pH (pH) by the presence of a solution (Folin-Denis reagent) using (DPP)(A) of the first wave (B) of the second wave

Effect of Drop Time

The effect of drip drop time with voltage was studied by conducting several experiments to obtain the best time for droplet fall and the results obtained were shown in Table (2).

Drop time (sec)	Ip_1 (nA)	Ip_2 (nA)
0.4	9200.0	8000.0
0.6	13000	12800
0.8	15800	15600
1.0	19200	18400
1.2	23200	21200
1.4	26800	23200
2.0	38200	32800
3.0	43600	40200

Effect of Pulse

The differential pulse pologram was studied to study the effect of pulse capacity on the diffusion current of the reductor regulators of the folin-Denis reductor reduction products by uric acid using pulse capacity ranging from 20-100 mV, The best value of the pulse capacity is 100 millivolts, giving the best shape in addition to the best value of the propagation current (Ip) of both waves, so it is installed in clinical applications and use.

Effect of Height of Uric Acid without Addition of Urine

The differential pulse polarograph of uric acid was recorded with different concentrations ranging from ($0.999*10^{-6}$ -$9.90099*10^{-6}$) molar, under optimal conditions identified. Table (3) shows the results obtained.

Conc. of U.A. (M) × 10^{-6}	Ip_1 (nA) × 10^4	Ip_2 (nA) × 10^4
0.999	24.665	22.23
1.996	54.665	34.23
2.991	84.665	48.23
3.984	118.665	58.23
4.975	146.665	90.23
5.964	188.665	102.23
6.951	214.665	118.23
7.936	236.665	134.23
8.919	254.665	152.23
9.900	280.665	170.23

It is noted from Table (4) that the value of the propagation current is increased on a regular basis with increased concentration. , And Figure (3) shows the relationship between the concentration of uric acid and the current current values of both waves. Two straight lines were obtained

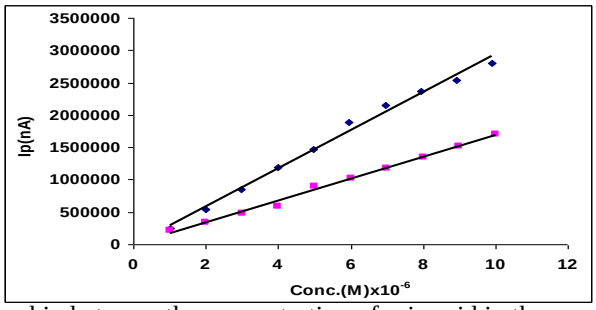


Figure 3. Shows the relationship between the concentration of uric acid in the presence of Folin-Denis reagent and the propagation current values of both reduction regimens using DPP technique.

Effect of Height of Uric Acid without Addition of Urine

The effect of increasing the concentration of uric acid on diffusion current values at different concentrations ranged from (0.994 $*10^{-6}$ - $9.8522*10^{-6)}$. The measurements were carried out under optimal conditions previously identified. The results obtained are shown in Table 5,and shows at figuer 4

Table 5. The effect of the concentration on the diffusion current (Ip) and the reduction effort (Ep) on uric acid demonstrated the presence of chemical potential using DPP technique

Conc. of U.A. (M) × 10^{-6}	**Ip_1 (nA)**	**Ip_2 (nA)**
0.994	3939.906	2141.665
1.986	7739.906	8541.665
2.991	12139.906	10341.665
3.964	15539.906	13941.665
4.950	19939.906	16941.665
5.934	23739.906	20341.665
6.916	25739.906	23741.665
7.897	30539.906	27141.665
8.875	35539.906	30741.665
9.852	39339.906	34341.665

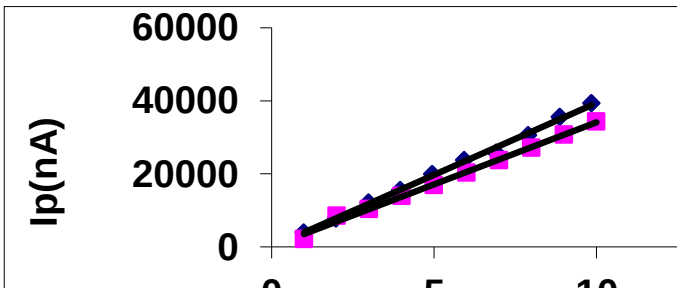


Figure 4. Shows the relationship between the concentration of uric acid with the presence of Folin-Denis reagent with the current values of the addition with the presence of the reduction of both reduction curves using DPP technique

Clinical Applications of Uric Acid via Chemical Method

The uric acid (mg / 24hr) was estimated to generate healthy and sick people using differential pulse pulmonary (DPP) according to optimal conditions described previously.

Relationship Between DPP Method and Spectrophotometric Method

To compare the proposed DPP method and the colorimetric method used to estimate the concentration of uric acid (mg / 24hr) in the compost, 25 samples of the administration samples were divided into 9 samples of normal persons) And (16) a sample of people with kidney disease, kidney failure and hypertension.

The amount of uric acid in these samples was estimated by the chemical method using the Volyn-Denis detector and compared with the color method, which is a routine method used to measure uric acid (mg / 24hr) in the administration samples, The results obtained from both the DPP method and the colorimetric method are shown in figur (5), and by taking the mean value of the concentration Uric flashing (mg / 24hr) in normal and pathological condition in both methods .

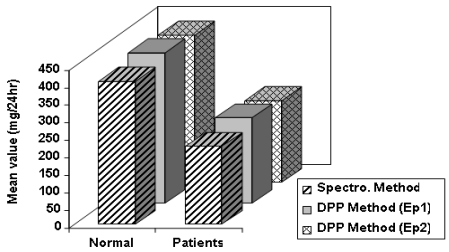


Figure 5. Shows the comparison between the DPP method and the colorimetric method for estimating uric acid - the chemical method in both normal and pathological conditions

In order to prove the accuracy of the comparison between the proposed polarographic methods (DPP) and the chromatic method for estimating the concentration of uric acid (mg / 24hr), the correction equations (1) of the first wave and (2) of the second wave are used:

DPP method = [(21.73815) + (0.997431× colorimetric method)] .....(1)
DPP method = [(12.32271) + (0.997202 × colorimetric method)] .....(2)

Conclusion

The use of DPP is one of the most recently proposed methods for estimating uric acid in mg / 24hr in healthy individuals with renal disease and renal failure and hypertension. Comparison of the results obtained from this method with the chromatic method routinely used in pathological analyzes. It was found through the results obtained between the two methods that the proposed polarographic method gave results consistent with the results obtained in the color method with the distinction of the first method of the following: Economic, Characteristics of solutions ,Interferences, and Sensitive

Recommendations

Add recommendations here. Add recommendations here. Add recommendations here. Add recommendations here. Add recommendations here. Add recommendations here. Add recommendations here. Add recommendations here.

Acknowledgements or Notes

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Author Information

Eman A.M. Al-Jawadi
Mosul University/College of science /Biophysics Dept., Mosul / Iraq
Contact E-mail : *e_abd2012@yahoo.com*

Haitham A.A. AL-Wahab
Mosul University/College of science /Chemistry Dept., Mosul / Iraq