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THE ELECTROCHEMICAL OXIDATION OF PARACETAMOL ON THE GOLD ELECTRODE IN AN ACIDIC MEDIUM

Abstract: *In this study, the electrochemical behavior of acetaminophen (paracetamol) was studied on a gold electrode. Depending on the cyclic voltammetry method in an acidic medium.*

The effect of various factors (concentration of material, velocity of survey) on electrochemical behavior was also studied.

The amperes showed that the oxidation process of acetaminophen takes place on a single stage with 2 electrons and accordingly the proposed mechanism for the oxidation process has been written.

The study showed the change of oxidation potential by changing the value (pH)

Keywords: *Electrochemical behavior, acetaminophen, polarography, paracetamol.*

ЭЛЕКТРОХИМИЧЕСКОЕ ОКИСЛЕНИЕ ПАРАЦЕТАМОЛА НА ЗОЛОТОМ ЭЛЕКТРОДЕ В КИСЛОЙ СРЕДЕ

Аннотация: *В этом исследовании электрохимическое поведение ацетаминофена (парацетамола) было изучено на золотом электроде. В зависимости от метода циклического напряжения в кислой среде.*

Также изучалось влияние различных факторов (концентрация материала, скорость съемки) на электрохимическое поведение.

Амперы показали, что процесс окисления ацетаминофена происходит на одной стадии с двумя электронами, и, соответственно, был предложен предложенный механизм процесса окисления.

*Исследование показало изменение окислительного потенциала путем изменения значения (pH)***.**

Ключевые слова: *Электрохимическое поведение, ацетаминофен, полярография, парацетамол.*

1. Introduction

Acetaminophen or what is known as paracetamol is a medicinal compound and is used as a pain reliever such as headache, back pain, arthritis, and postoperative pain [1]. It is also used to relieve fever pain [2]. Acetaminophen has a weak acidic characteristic (pKa = 9), and is characterized by its rapid absorption into the body and ease of its excretion through the urine [3]. It does not have side effects, but overdoses may cause liver damage and kidney poisoning [4]. Chemists have resorted to identifying acetaminophen in many pharmaceutical preparations, either alone or within biological samples, using several methods such as spectral methods and liquid chromatography method [5, 6] that require a lot of time, so attention was drawn to the use of electrolysis techniques that were characterized by high sensitivity in addition to It does not require a long time and is less expensive compared to other methods. The electrochemical behavior of acetaminophen was studied on the glass graphite path within different pH values depending on the cyclic voltammetry method. The results showed a peak oxidation in acidic and two oxidation and return peaks in alkaline media [7].

2. Experimental:

2.1. Instruments and materials:

Electrochemical measurements were carried out with ampere-metric station model (Amel 443), the reference electrode Ag/AgCl (0.5 M KCl) and gold is the working electrode. All experiments were carried out at laboratory temperature (25 °C). Paracetamol and other used materials were high purity produced by Batch Company.

3. Results and Discussion:

The electrochemical behavior of the paracetamol (1.10^{-3} M) was studied in the presence of (KCl 0.5M) as a supporting electrolyte where hydrochloric acid added in different concentrations (1.961×10^{-3}, 3.846×10^{-3}, 7.407×10^{-3}, 1.3793×10^{-2} M). Depending on the cyclic voltammetry method (starting voltage (0.0 V), end voltage (1.0 V), scaning rate (50 mV / s)), and after disposal of the dissolved oxygen by rubbing the solution with pure nitrogen gas for 15 minutes the curve was obtained shown in Figure (1).

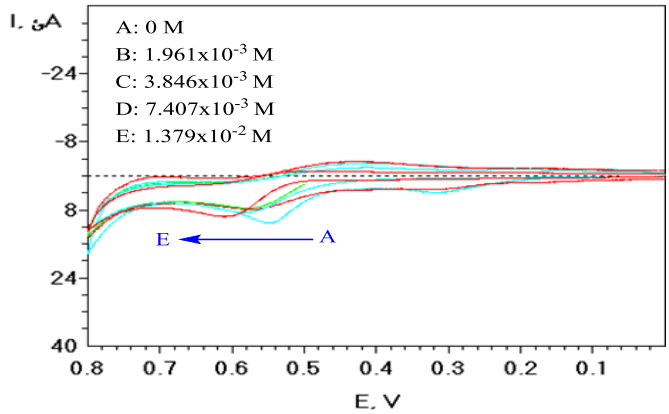


Figure (1): (CV) curves of paracetamol oxidation on the gold electrode at different concentrations of HCl in the presence of supporting electrolyte (KCl 0.5M) and comparative electrode (Ag/AgCl).

We observe the increase in the intensity of the current by increasing the acid concentration, and by drawing the relationship between ($E_{1/2}$) and (pH) we obtain the following diagram:

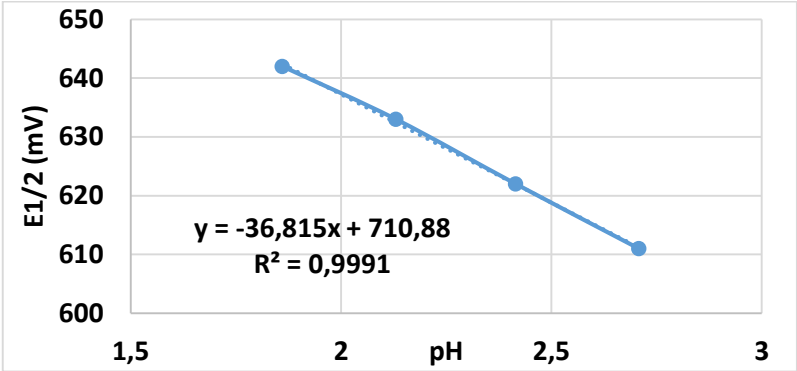


Figure (2) the relationship of the $E_{1/2}$ with (pH) in the presence of a support electrolyte (KCl 0.5M) and comparative electrode (Ag/AgCl).

As we notice the inverse linear relationship between ($E_{1/2}$) and (pH).

To calculate the total number of electrons, we draw the relationship between (log (id-i / i)) in terms of (E) we get the following graph:

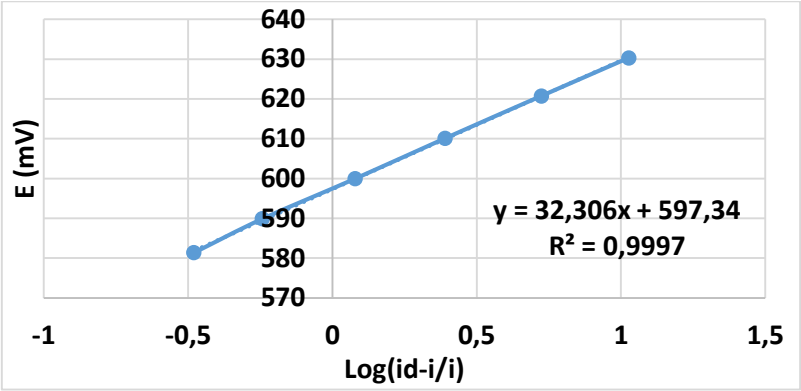
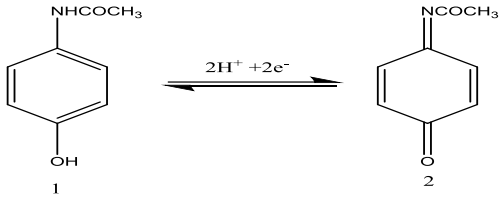


Figure (3): The relationship between E and (log (id-i / i) of the paracetamol oxidation polarogram in an acid medium with the presence of a supporting electrolyte (KCl 0.5M) and comparative electrode (Ag / AgCl).

It was found that the graph crosses the vertical axis (the latency axis) at the point (597.34 mV). From the slope of the straight line we can calculate the number of transferred electron n=1.909 the total number of electrons is equal to 2e. The proposed mechanism for this reaction is indicated by the following chemical equations:



Determination of paracetamolin medical sample:

The relationship between the current intensity and the concentration of paracetamol in range ($4x10^{-3}$ – $1x10^{-2}$ M) was studied by cyclic voltammetry, Frome figure (5) there wasa linear relationship and the equation was I= 10199C-3.2898 (R= 0.9992). The previous procedure was applied to analyze a pharmacological sample of paracetamol and it contained 97.08%.

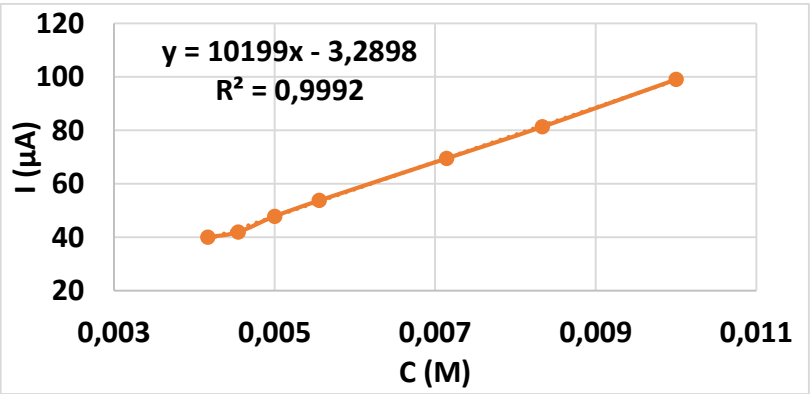


Figure (4): The relationship between I (μ A) and C(M) of the paracetamol.

4. Conclusion:

• The electrochemical behavior of paracetamol has been studied on the gold electrode in acidic medium.

• It was found that by reducing pH the oxidation potential shifted to the higher values.

• The total number of electrons was calculated and it was (2) electrons, and the appropriate reaction mechanism was suggested.

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