Effect of Adsorption on Electrical Conductivity Values, Ionization Constant and Degree to Di Hydroxy Benzoic acid By Using Natural Surfaces

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Abstract. The effect of the adsorption process on electrical conductivity, equivalent conductivity, ionization constant and dissociation degree was studied to Di hydroxy benzoic acid with different concentrations by using natural surfaces (Hazelnut peel and walnut peel). The results refers to decrease electrical conductivity after acid adsorption on both surfaces. The effect of acid concentration on the degree of disintegration and the ionization constant was also studied.

1. The Theoretical
The carboxylic acid molecule is polarity [1]. So it can be form hydrogen bonds with other molecules such as the solvent, this leads to the melting of acid in the water.

That the acidic carboxylic acids depend on the structural formula of it .its ability to give the hydrogen ion of the carboxyl group easily more than the hydrogen ion given in the alcohols. The composition of carboxylic acid can be as follows [2]

\[
\begin{array}{c}
R-C-O-H
\end{array}
\]

The solvent has an effect on the acidity of carboxylic acids due to the process of interference between solvent and solubility through the formation of hydrogen bonds, as well as the presence of intrinsic or internal hydrogen bonds in carboxylic acids, which cause a conglomeration of acid molecules that greatly affect acidity [3, 4, 5].

\[
\begin{array}{c}
R-C-O-H \underset{H^+}{\overset{H}{\leftrightarrow}} R-C-O^+ + H^-
\end{array}
\]

The adsorption is a phenomenon of attracting and retaining the molecules of a substance on the surface of a liquid or solid resulting into higher concentration of the molecules on the surface.

The substance which is adsorbed on the surface is called adsorbate and the substance on which adsorption takes place is called adsorbent. Adsorption differs from the phenomenon of absorption. [6]
The process of adsorption is a complex phenomenon that depends on the nature of the adsorbent and the nature of the active sites on the surface. The adsorption of carboxylic acids on the surfaces natural, which has the ability to adsorb polarized particles with electrostatic forces, affects the acidity of carboxylic acids [7, 8].

The carboxylic acid when dissolved in water dissociates in to ions, the phenomenon of electrical conductivity was used in this research to identify the constant ionization or disintegration of acid Ka which requires designation the degree of dissociation α by measuring equivalent conductance \( \Lambda_0 \) and equivalent conductance at infinite dilution \( \Lambda_c \).

Carboxylic acid ionization parameters are influenced by multi- factors such as steric effect, drag and e-payment of the compensated aggregates and the implicit and intrinsic hydrogen bonds [9].

2. Practical Part

1. Five concentrates of benzoyl-carboxylic acid were prepared with concentrations (0.3, 0.6, 0.9, 0.12, 0.15)M.
2. The surface is prepared by taking a quantity of hazelnut husks and cleaned and then washed with distilled water several times and dried and then grinded and used to adsorb acid solutions.
3. Measurements of electrical conductivity and the process of adsorption of hydrolysis to di hydroxy benzoic acid in water bath at 25 ° C and a half hour for all samples using 0.3 g of hazelnut husks as adsorbent. A surface separation was performed using a centrifuge and taken (15 Ml) for each concentration of the carboxylic acid to measure the conductivity pre and post adsorption.
4. Measurements concentration of carboxylic acid by titration against sodium hydroxide and using the Ph.Ph as indicator.

3. Results and Discussion

This acid contains an aromatic ring instead of a hydrogen atom at the Alpha site as well as the possibility of an underlying hydrogen. This acid contains an aromatic ring instead of a hydrogen atom at the Alpha site, as well as the possibility of the existence of an integral hydrogen in it. This affects both the electrical conductivity of the water solution of the acid, the equivalent conductivity, the degree of disintegration and the constant ionization of natural surfaces obtained by the process of adsorption of acid particles and ions.

The results obtained before and after adsorption were confirmed in Table (1), (2) and (3), respectively:

| Conc. M | \( K \times 10^{-3} \) (ohm·cm\(^{-1}\)) | \( \Lambda_{eq} \) (ohm·cm\(^{-1}\)·equ\(^{-2}\)) | \( \sqrt{C} \) | \( \Lambda_0 \) (ohm·cm\(^{-1}\)·equ\(^{-2}\)) | \( \alpha \) | Ka |
|---------|-----------------|-----------------|---------|-----------------|---------|-----|
| 0.03    | 0.148           | 4.94            | 0.1732  | 0.716           | 0.352   |
| 0.06    | 0.208           | 3.46            | 0.2449  | 0.502           | 0.350   |
| 0.09    | 0.241           | 2.67            | 0.3     | 6.8915          | 0.3874  | 0.340 |
| 0.12    | 0.29            | 2.416           | 0.3464  | 0.3505          | 0.348   |
| 0.15    | 0.319           | 2.126           | 0.3872  | 0.3084          | 0.345   |

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Table 3. The ionization constant values and degree of disintegration of carboxylic acid after adsorption on walnut peel

| Conc. M | $K \times 10^{-3}$ (ohm$^{-1}$cm$^{-1}$) | $\Lambda_{eq}$ (ohm$^{-1}$cm$^{-1}$equ$^2$) | $\sqrt{C}$ | $\Lambda_0$ (ohm$^{-1}$cm$^{-1}$equ$^2$) | $\alpha$ | $K_a$ |
|---------|----------------------------------------|------------------------------------------|------------|---------------------------------------|---------|-------|
| 0.0857  | 0.135                                  | 1.5752                                   | 0.2927     | 10.226                                | 0.154   | 0.2121|
| 0.0937  | 0.191                                  | 2.0384                                   | 0.3061     | 0.227                                 | 0.199   | 0.2449|
| 0.0989  | 0.23                                   | 2.3255                                   | 0.3144     | 10.226                                | 0.227   | 0.2664|
| 0.0882  | 0.27                                   | 3.0612                                   | 0.2969     | 0.299                                 | 0.299   | 0.2966|
| 0.0967  | 0.299                                  | 3.092                                    | 0.3109     | 0.302                                 | 0.302   | 0.3049|

The results show several facts:
1. Increase the electrical conductivity of the water solutions of the acid by increasing the concentration of solutions before and after the adsorption process on the surfaces of Hazelnut and walnut peel. But its value on the surface of the Hazelnut peel is slightly larger than the surface of the walnut peel is due to the adsorption sites on the surface of the walnut peel more adsorption sites on the surface of the Hazelnut peel. Thus reduce the number of free ions (electrically conductive) in the water solution on the surface of the walnut peel larger. Of its presence in the water solution of the acid on the surface of the Hazelnut peel, so the value of electrical conduction using the surface of the Hazelnut peel greater than its value when the surface of the surface walnut peel.
2. Reduction of the equivalent conduction values by increasing the concentration of acid before adsorption due to the high number of ions present in the solution. The interaction between the positive and negative ions is increased by increasing the concentration of acid forming electronic pairs (unable to carry the electrical current) Which creates from the approach of ions with opposite charges from each other. In addition, the continuous increase in acid concentration leads to acid aggregation and prevents ionization by forming hydrogen bonds between the acid molecules (10) as shown in Figure 1.

After adsorption, there is a significant decrease in the equivalent conductivity compared with the equivalent conductivity prior to adsorption as shown in the tables (1, 2 and 3). The equivalent conductivity at the maximum dilution values were determined through the Cross the straight line drawn between the square root of the acid concentration versus the equivalent conductivity values before and after adsorption with the y axis. As shown in the shapes (2, 3 and 4).
Figure 1. Equivalence values the concentration of carboxylic acid prior to adsorption on Hazelnut peel

Figure 2. Equivalence values versus square root of the concentration of carboxylic acid prior to adsorption on Hazelnut peel
3. The degree of disintegration($\alpha$) is reduced by increasing acid concentration prior to adsorption and increasing its value by increasing acid concentration after adsorption. As shown in the tables(1,2 and3). This is due to the fact that before adsorption, the greater the concentration of acid, the more the free ions increase in the solution, the greater the formation probability of the ion pair, which is unable to carry the electrical current, will decrease the equivalent conduction and decrease the degree of disintegration ($\alpha = \frac{\alpha'}{\alpha_0}$).

After adsorption, the concentration of acid is significantly lower than its concentration prior to adsorption because part of the acid has been adsorbed on the surface. The greater the concentration after adsorption, the more free ions that are capable of carrying the electric current lead to increase the degree of disintegration($\alpha$).

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