# Determination of Iron content in Iron Tablets by Redox Titration

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**Abstract:**

This study focused on estimating iron content in five brands of pharmaceutical products by using a redox titration. (0.002 m) of potassium manganite (V II) solution was used as oxidizing agent. The study showed that the total iron content in pharmaceutical samples ( A , B ,C , D and E ) had 79.52 mg , 65.52 mg , 40.8 mg , 98.0 mg and 58.24 mg per 80 , 66 , 42 , 100 , and 60 mg respectively . These results are in good agreement with pharmacopoeial range and the proposed method gave a very recovery (97.06 and 99.4) %.

**Keywords:** *Redox titration , iron tablets .*

## تحديد محتوى الحديد في أقراص الحديد بطريقة معايرة الأكسدة والاختزال

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**الملخص:**

ركزت هذه الدراسة على تقدير محتوى الحديد في خمسة أصناف تجارية لمنتجات دوائية باستخدام معايرات الاختزال. (0.002M) من محلول برمنجنات البوتاسيوم استخدم كعامل مؤكسد. أظهرت الدراسة أن إجمالي محتوى الحديد في الغينات الدوائية A, B, C, D, E كان 79.52 ، 56.52 ، 40.8 ، 98.0 ، 58.24 مليجرام لكل (80، 66، 42، 100 و 60 مليجرام) على التوالي. هذه النتائج توافقت مع المدى الدوائي والطريقة المقترحة أعطت قيم 97.06 , 99.4 % RV.

**الكلمات المفتاحية:** *معايرة الأكسدة والاختزال، أقراص الحديد.*

## Introduction:

In the chemical analysis various methods of qualitative and quantitative analytical chemistry are used (Harris, 1987). According to the type of physical size , which in the final analysis is the measurement methods of quantitative chemical analysis and it is divide into two main groups ; traditional methods of analysis and instrumental methods of analysis. Traditional methods include volumetric and gravimetric methods of

analysis, while the instrumental methods of analysis based on the measurement of physical quantities. These methods include potentiometry, conductometry, spectrophotometry , photoelectric etc. (Vindakijević, & Sladojević, 2005).
Group of methods estimating the volume of solution of known concentration of the substance , which came in response to the tested ingredient in foods , called volumetric titration. The best known are the redox and complexometric titration and the neutralization reaction, which can be applied for determining the content of certain minerals and vitamins in food and drugs (Grujić et al., 2007).

Iron is an essential mineral of hemoglobin , which transports oxygen in the blood to all parts of the body. It also play several important roles in metabolic reactions and required for many biological functions such as reproduction , healing of wounds and oxidative metabolism (Park, 2011). If the iron concentration is not enough in the body, may be cause many disease such as anemia, dyspnea on exertion, irritability, cheilosis, increased susceptibility to infection, impaired memory and concentration etc (ICMR, 2010). The adult human body contains 3-5 gm of iron in which of iron is present in myoglobin of muscle and 70 % of iron is in the erythrocytes of blood as constituent of Hemoglobin. Diaily requirement of iron in adult is 8-11 mg / day for males while daily nutritional requirement of iron in woman is 18 mg / day for menstruating woman and 40 mg / day for lactating and pregnant women (WHO, 2001). The main sources of iron in the human diet are leafy and meat, green vegetables and its deficiency can lead to various diseases and disorders. To avoid this condition iron supplements can be help to avoid disease of deficient diet and can be used to improve the health of consumers (Adamson, 2008). Iron supplements can be prepared for different drugs form as capsules , tablets , ampules , injectable and syrup . while the chemical forms of iron whose use is permitted in the manufacture of nutition al supplements are ferrous sulphate (high strength), ferrous glucanate ( medium strength tablets ), ferrous fumarate (high strength tablets or syrup) and sytron ® syrup ( sodium feredatate ) ( low strength) (Mutschler et al., 1995). Many analytical techniques have been proposed for the determination of iron , these include volutammetric methods (Lutka et al., 2004), atomic emission and atomic absorption spectrometer (Revanasiddappa & Kumar, 2003; Roldan et al., 2005), spectrophotometry (David, 1958), capillary electrophoresis (Pozdniakova, 1998), and chromatographic techniques (Inoue, H., & Ito, 1994; Nakajima et al., 1993).
Here, a simple, cheap, safe and rapid redox titration method has been carried out for an investigation of total iron content in various iron tablets available in local pharmacy store using potassium permanganate ( KMno4 ) as a titration reagent.

**Materials and Methods:**

All the reagents used were of analytical grade and deionized water used to prepare all solutions. Potassium permanganate (0.002 M) solution was prepared by dissolving 0.0791 mg in 250 ml distilled water, 0.5 M sulphur acid was prepared by taking 13.6 ml of concentration sulfuric acid in 500 ml distilled water.

**Sample collection:**

Iron tablets were commercially purchased from different pharmacies of AL-Khoms city of Libya . The strength of each sample is shown in Table 1:

**Table 1 : The strength of five commercial Brands .**

| Commercial Brands | Strength ( mg ) |
|---|---|
| A | 80 |
| B | 66 |
| C | 42 |
| D | 100 |
| E | 60 |

Potassium permanganate ( VII ) solution.
The potassium permanganate ( KMno4 ) itself reduced to manganese (II) in acidic solution and oxidize iron (II) to iron (III). The reaction is represented by the equation:
$Mno4^{-}$ ( eq ) + 8 $H^{+}$ (eq) + 5 $Fe^{+2}$ (eq) → $Mn^{+2}$(eq) + 4 H2O (L) + 5 $Fe^{+3}$ (eq)

**Preparation of the drug samples:**
Five tablets of each of the drugs ( A, B, C, D and E ) were powdered in a porcelain mortar and pestle. Accurately weighed of each tablet were transferred in to a volumetric flask. Add 100 ml of ( 0.5 M ) H2SO4 for each a volumetric flask and stir until dissolve all powdred samples. After dissolving , the five solutions were filtered and transferred into five a 250 ml calibrated flask The distilled water was added up to the mark.

**Titration procedure:**
Pipette 25 ml of iron (II) solution for five a 250 ml Erlenmeyer flasks. Acidify these solution by adding about 10 ml of dilute sulfuric acid . Titrate the iron (II) solution with (0.002M) potassium permanganate solution from a burett until a pink colour disappears. Repeat the procedure three times and record the mean of potassium permanganate volume.

**Results and Discussion:**
The amount of iron for five commercial Brands of iron tablet is calculated from the expression:

$$VA \cdot MA \cdot NB = VB \cdot MB \cdot NA$$

Where VA volume of iron (II) solution used in each titration.
MA concentration of iron (II).
NB moles of potassium manganate.
VB Volume of spent potassium manganite ( ml ).
MB concentration of potassium mangante ( VII ).
NA moles of iron.
To convert to g of iron of each sample use.
Mass of iron = moles of iron x Am.
where Am is molecular mass of iron.
The iron content of five pharmaceutical samples were tabulated in (Table 2).

**Table 2 : Amount of iron found in five different iron tablets by redox titration.**

| Iron Tablets | Weighed mass in ( mg / tablet) |
|---|---|
| A | 79.52 |
| B | 65.52 |
| C | 40.8 |
| D | 98.0 |
| F | 58.24 |

The result revealed that the iron content in iron samples ( A , B , C , D , and E ) from five different Brands by redox titration method were found to be 79.52, 65.52, 40.8, 98.0 and 58.24 mg per 80, 66, 42, 100, and 60 mg respectively.
The results of tests indicate no much deviation between the values that are listed in products and the value obtained by applying the used titrimetric methods of analysis. The result could be caused be errors in judging the end point or decompose of potassium permanganate solution with the time. Recovery values of all tested dietary supplements are shown in Table 3. They were obtained as the ratio of the calculated mass of the tested iron and theoretical mass of iron analyzed sample multiplied by 100 %.

**Table 3 : Recovery values for all analysed iron tablets.**

| Iron Tablets | Recover value ( % ) |
|---|---|
| A | 99.4 |
| B | 99.27 |
| C | 97.14 |
| D | 98.0 |
| E | 97.06 |

Recovery measurements were ranged from 97.06 % to 99.4 % .

**Conclusion:**

The iron contents in iron tablets were successfully measured by using a standard solution of potassium manganite ( VII ) . Statistically no significant difference between the calculated and theoretical values and the amount of iron contained in all the samples lies within the pharmacopeial range . on that basis , it can be concluded that the volumetric analysis method suitable for the determination of iron content in the tested pharmaceutical substances.

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