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# An eco friendly method of total iron estimation in HBI /DRI

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## ABSTRACT

Metallization of Hot briquetted iron (HBI) and Direct reduced iron (DRI) plays key role in Steel making process. Total Iron estimation is a part of Metallization, conventionally it is estimated by dissolving sample in Hydrochloric acid (HCl) to convert Fe into Ferric (III) followed by Ferrous F (II) with Stannous chloride. Mercuric chloride is added in this process which is hazardous in nature causes impact to environment. In this new Eco friendly method of Total Iron estimation in HBI/DRI where sample is dissolved in dilute sulfuric acid (H2SO4) to convert Fe to Fe (II) directly. The results are matching for both the methods. This new method is applicable to HBI/DRI samples where metallization is >90%. Not applicable to Iron Oxides. 

## KEYWORDS

An eco friendly method of iron estimation;
HBI/DRI chemical analysis;
iron estimation by sulfuric acid method;
A new method of total iron estimation;
Total iron estimation in HBI/DRI.

## INTRODUCTION

Standard method of total iron in HBI/DRI is by dissolving sample in HCl to convert Fe into FeCl3 followed by reduction with stannous chloride (SnCl2) to convert Fe (III) to Fe (II) further reaction with Mercuric chloride to react with excess SnCl2. In the new method of Total Iron estimation in HBI/DRI where sample is dissolved in dilute sulfuric acid (H2SO4). In this eco friendly method Iron will be in Fe (II) stage, so hazardous chemicals SnCl2, HgCl2 treatment not required. Rest procedure[2] is same for both the methods.

### Brief procedure

In this eco friendly method the main difference is usage of poisonous Mercuric chloride is avoided. Hydro fluoric acid added in both the methods to remove silica. Titration with Potassium dichromate is common to estimate Iron is same. Dilute Sulfuric acid converts Fe to Fe (II) direct no need to reduce with stannous chloride and Mercuric chloride usage.

## EXPERIMENTAL PROCEDURE

Reagents required: All are pure analytical grade reagents.

1. Sulfuric acid H2SO4
2. Phosphoric acid H3PO4
3. Hydro fluoric acid HF
4. Diphenyl amine indicator DPA
5. Potassium Dichromate K2Cr2O7

### Preparation of sulfuric acid

Dilute Sulfuric acid is prepared carefully by adding Sulfuric acid 250ml to 750ml distilled water. Cool and make with water up to one liter. Other reagent preparation potassium dichromate, Sulfuric, phosphoric acid mixture and indicator are as per method[1]

### Total iron in HBI/DRI

0.2gm sample dissolve in 25 ml dilute sulfuric acid

and add few drops HF. Keep at low heat till dissolution (approximately 15 minutes). Cool and titrate with K2Cr2O7 solution using indicator and acid mixture.

**TABLE 1: Comparison table of total iron with classical (HCl) and new method (H2SO4) few results are given in TABLE.**

| S. NO | Classical method HCl | New method H2SO4 | Difference HCl–H2SO4 |
|---|---|---|---|
| 1 | 85.02 | 84.91 | 0.11 |
| 2 | 86.08 | 86.12 | -0.04 |
| 3 | 85.61 | 85.42 | 0.19 |
| 4 | 85.65 | 85.59 | 0.06 |
| 5 | 85.46 | 85.45 | 0.01 |
| 6 | 83.59 | 83.79 | -0.20 |
| 7 | 85.39 | 85.57 | -0.18 |
| 8 | 84.62 | 84.65 | -0.03 |
| 9 | 85.26 | 85.15 | 0.11 |
| 10 | 85.95 | 86.15 | 0.20 |
| 11 | 84.99 | 84.96 | 0.03 |
| 12 | 84.77 | 84.71 | .0.06 |
| 13 | 86.14 | 86.34 | -0.20 |
| 14 | 84.56 | 84.67 | -0.11 |
| 15 | 90.49 | 90.62 | -0.13 |
| 16 | 91.02 | 90.95 | 0.07 |
| 17 | 90.68 | 90.54 | 0.14 |
| 18 | 91.36 | 91.22 | 0.24 |
| 19 | 90.67 | 90.87 | -0.20 |
| 20 | 91.34 | 91.21 | 0.13 |
| 21 | 91.04 | 91.19 | -0.15 |
| 22 | 91.13 | 91.04 | 0.09 |
| 23 | 83.13 | 83.22 | -0.09 |
| 24 | 89.34 | 89.51 | -0.17 |
| 25 | 87.99 | 88.02 | -0.03 |
| 26 | 84.68 | 84.54 | 0.14 |
| 27 | 88.56 | 88.39 | 0.17 |
| 28 | 86.12 | 86.17 | -0.05 |
| 29 | 87.54 | 87.67 | -0.13 |
| 30 | 90.12 | 90.25 | -0.13 |

## Calculation

$$\text{Total iron} = \frac{\text{Burette reading x Normality of } K_2Cr_2O_7 \text{X0.05585x100}}{\text{Weight of sample}}$$

## CONCLUSIONS

This is absolutely eco friendly method in addition to cost and time saving benefits. This method is applicable to reduced iron only not for iron oxide. The difference in Total Iron value is within limits of +/- 0.2 which is acceptable. Some extra safety measures to be taken while diluting Sulfuric acid.

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## REFERENCES

**[1]** Methods of chemical analysis of iron ores IS: 1493(6)-1990.

**[2]** Total iron determination by stannous chloride-dichromate titration midrex manual page 56.