Short Communication
Pak. j. sci. ind. res., vol. 35, no. 6, June 1992

Preparation of Ferrous Sulfate from Iron Rolling Scale

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(Received February 1, 1992; revised June 29, 1992)

Ferrous sulfate (Hydrated) was prepared from the iron rolling scale, produce as a waste in the Metropolitan Steel Corporation Karachi [1]. The disposal of this waste is a major problem and considerable studies has been undertaken in these laboratories to utilize this waste for the preparation of ferric chloride [2]. Ferrous sulfate is mainly used in the preparation of blue black ink, as weed killer, fungicide, insecticide and as a coagulant. Ferrous sulfate can be prepared by the reaction of lead sulfate and iron at 54° [3]. It can also be obtained as a by-product in the manufacture of chrome alum [4] and by reacting a slurry of gypsum and freshly precipitated ferrous hydroxide or ferrous oxide in an atmosphere of CO_2 [5].

$$FeO + CO_2 + CaSO_4 = CaCO_3 + FeSO_4$$

The present communication is related to the utilization of the huge quantity of iron rolling scale for the preparation of ferrous sulfate. The chemical composition of the iron rolling scale has been given in Table 1. The iron rolling scale was dissolved in different concentrations of HCl and H_2SO_4 and it was noted that the scale is soluble to an extent of 90% in HCl (11.5M) and 50% in H_2SO_4 (2.5M). The result are shown in Table 2. The recovery of ferrous sulfate by direct treatment of the scale with H_2SO_4 has been found to be 50% whereas the recovery could be increased to 80% by dissolving the scale in 11.5M HCl so that ferrous chloride is formed, which is then converted into ferrous sulfate by the addition of 2.5M H_2SO_4. The findings are shown in Fig.1.

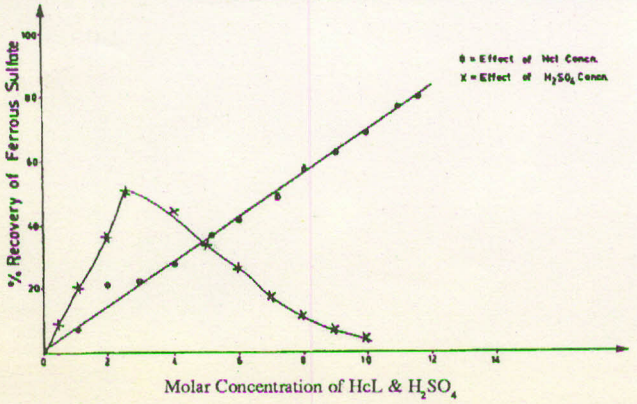

Fig. 1. Effect of HCl and H_2SO_4 concentration on the recovery of ferrous sulfate.

The effect of temperature and time of digestion has also been studied and it was found that the maximum recovery of ferrous sulfate occurs at a temperature of 90°and for a period of 7 hrs. digestion time. The results are indicated graphically in Fig. 2.

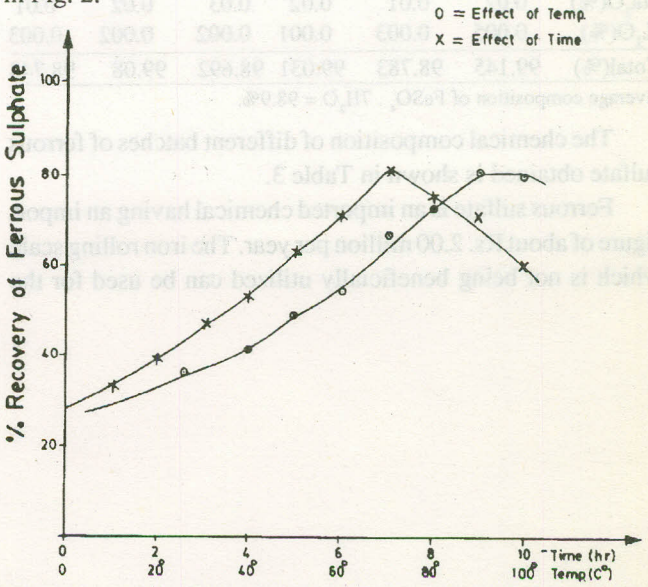

Fig. 2. Effect of time and temperature on the recovery of ferrous sulphate.

TABLE 1. CHEMICAL COMPOSITION OF THE IRON ROLLING SCALE.

Cement	Percentage
Silica as SiO_2	0.25
Iron as Fe_2O_3	99.16
Calcium as CaO	0.25
Magnesium as MgO	0.18
Sodium as Na_2O	0.08
Potassium as K_2O	Nil

TABLE 2. SOLUBILITY OF THE ROLLING SCALE IN HCl AND H_2SO_4 AT 80°.

Weight of iron rolling scalegms.	Temp. (°C)	Conc. of HCl (M)	Solubility (%)	Conc. of H_2SO_4 (M)	Solubility (%)
10	80	1	8.3	1.0	12.1
"	"	2	15.2	1.5	25.3
"	"	3	24.6	2.0	38.2
"	"	4	33.5	2.5	51.3
"	"	5	40.1	3.0	43.2
"	"	6	47.2	3.5	38.5
"	"	7	56.8	4.0	31.2
"	"	8	63.5	4.5	24.7
"	"	9	70.2	5.0	16.3
"	"	10	78.3	5.5	10.1
"	"	11.5	90.2	6.0	6.7

TABLE 3. PERCENTAGE COMPOSITION OF $FeSO_4$, $7H_2O$ CRYSTALS.

FeO(%)	25.42	25.30	25.40	25.35	25.40	25.45
SO_3(%)	28.52	28.40	28.35	28.21	28.50	28.35
H_2O(%)	45.10	45.02	45.21	45.15	45.13	45.00
H_2O insoluble matter(%)	0.05	0.03	0.01	0.2	0.01	0.01
CaO+ MgO(%)	0.03	0.02	0.04	0.03	0.02	0.01
Na_2O(%)	0.02	0.01	0.02	0.03	0.02	0.01
K_2O(%)	0.005	0.003	0.001	0.002	0.002	0.003
Total(%)	99.145	98.783	99.031	98.692	99.08	98.748

Average composition of $FeSO_4 . 7H_2O$ = 98.9%.

The chemical composition of different batches of ferrous sulfate obtained is shown in Table 3.

Ferrous sulfate is an imported chemical having an import figure of about Rs. 2.00 million per year. The iron rolling scale which is not being beneficially utilized can be used for the production of commercially important chemicals at a considerably low cost. The production of locally produce chemicals will save foreign exchange being spent on the import of the chemical.

Key words: Preparation, Ferrous sulfate, Iron rolling scale.

References

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ERRATA

In the published issue of "Pakistan Journal of Scientific and Industrial Research", Vol. 34, No.5, May 1991 at page 202, the name of one author needs correction.

The name of S. Salam may be corrected as A. Salam instead of S. Salam.