



Effect of Absorbability of Iron Contents by Precipitated Barium Sulphate in the Commercial Crude Sodium Sulphide

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ABSTRACT

The paper presents the investigations on absorbability of ferri/ferrous impurities found in commercial grade sodium sulphide. The later product is unsuitable for the manufacture of pharmaceutical grade chemicals and dyes chemicals. The author have carried out experiments on the use of precipitated barium sulphate as an adsorbent in different proportions in the aqueous solution of commercial grade sodium sulphide. The findings are quite encouraging.

Keywords: Sodium sulphide, adsorption, precipitate, barite, Carbothermal reduction, barium sulphate.

1. INTRODUCTION

Sodium sulphide is largely obtained as a by-product of barium ore processing. It is a commercially important compound. Sodium sulfide is widely used in tanneries, dyestuff, textile industries, pharmaceutical grade chemicals etc[1-7]. The most extensive use is in the depilation of hides for leather before tanning, in wood pulp processing, desulfuration of rayon and cellophane, elastomers, lubrication, and organic compounds. It is used as a reducing agent, in ore flotation, in the recovery of metals as the insoluble sulfides.

The paper reports the investigations on absorbability of ferri/ferrous impurities found in commercial grade sodium sulphide. Sodium sulphide is not suitable for manufacture of pharmaceutical grade chemicals and dyes if iron impurities are present. Even the traces of iron reduces the cost of this valuable compound to the extent of 50 %.

In the present investigation author had used precipitated barium sulphate as an adsorbant and it was found that it acted as a fairly strong adsorbant due to its large specific surface area in the finely powdered state. Author had been chosen precipitated barium sulphate purposefully as it is readily available as a by-product of barium ore processing, cheap cost and large specific surface area. This property plays an important part in the adsorption process[1,2,5,8-9].

2. MATERIALS

Materials used for study were as follows:

i. Sodium Sulphide (Crude Commercial Product)

Supernatant solution obtained after soda ash treatment of barium sulphide extract contains sodium sulphide as the main

by-product. This supernatant solution on evaporation gives flakes of crude sodium sulphide, which is usually contaminated with iron contents as an impurity. The crude sodium sulphide was prepared by the author in the lab by carbothermal reduction of barite.

ii. Chemical Reagents (Potassium thiocyanate, KMnO_4 , $\text{HCl} - 4 \text{ N}$ etc.)

Most of the chemical reagents are of AR grade i.e. BDH products.

3. EXPERIMENTAL PROCEDURE

Experiments were conducted to investigate the adsorbability of precipitated barium sulphate for iron contents present in commercial crude sodium sulphide are as follows:

Preparation of Reagents

- i. **Potassium thiocyanate solution** - 20 gm of AR Potassium thiocyanate is dissolved in 100 ml of distilled water.
- ii. **KMnO_4 solution** - 2 gm of KMnO_4 AR is dissolved in 50 ml of distilled water and volume is made up to one litre.
- iii. **$\text{HCl} (4 \text{ N})$** - 36 ml of pure conc. HCl is added into 50 ml of distilled water and volume is made up to 100 ml.



Preparation of Sample Solutions

5 gm of sodium sulphide (iron contaminated) is dissolved in 100 ml of distilled water. In each solution the different amounts of finely powdered precipitated barium sulphate (1,5,10,15 and 20 percent by weight of sodium sulphide) was added. The solutions were warmed slightly on the low heat with vigorous shaking for 15 minutes and filtered. In the filter, 25 ml of conc. AR HCl was added. To expel the excess of acid the solutions were evaporated nearly to the dryness. The obtained residues were diluted with water. To oxidise the iron to the ferric state, a dilute solution of potassium permanganate was added in the above solution till the slight pink colour appeared. The volume of the solutions were made up to 250 ml with distilled water. From these solutions, estimation of iron was done as per the standard procedures. [8-12].

4. METHOD

To find out the percentage of iron contents in treated sodium sulphide, known amount of 50 ml sample solution is placed in a nessler cylinder. In this solution 5 ml of potassium thiocyanate solution and 2-4 ml of 4N-HCl is added.

In another nessler tube 50 ml of distilled water, all the above reagents are added and the standard iron solution is run from burette till the colours are matched.

Calculations were made according to the available Indian Standards [8-12]. Observed results are summarized in the Table -1 (1 ml standard iron solution of the sample contains 0.1 mg of iron) [12].

5. DISCUSSION

Absorbability of iron contents by precipitated barium sulphate powder is revealed in the Table 1. It is noted from the Table 1 that incorporation of precipitated barium sulphate reduces the iron contents considerably. Even the slight addition (as small as 1%) is sufficient to reduce the contamination of iron contents from 1.5 mg to 0.1 mg. This amounts to a very smooth and convenient reduction of iron contents to the extent of 0.005 percent or even less in the contaminated commercial sodium sulphide.

The plausible reason for this may be the formation of oppositely charged colloidal systems by iron and precipitated barium sulphate in the solution. After stirring these solutions a gelatinous coprecipitate is coagulated which is filterable easily and therefore can be removed by filtration. It is important to note that according to the above proposed mechanism, elimination of iron contents should be improved further by increasing surface area of precipitated barium sulphate and efficiency of filtration.

TABLE 1- Effect of Absorbability of Iron Contents by Precipitated Barium Sulphate in the Flakes of Sodium Sulphide

S.No	Na ₂ S used in grams	Precipitated BaSO ₄ used in grams	Observed value (ml)	Iron present in sodium sulphide after adsorption as 1 ml = 0.1 Fe
1.	5.0	0.00	15.0	1.5
2.	5.0	0.05	1.2	0.1
3.	5.0	0.25	1.0	0.1
4.	5.0	0.50	1.0	0.1
5.	5.0	0.75	1.0	0.1
6.	5.0	1.00	1.0	0.1

6. CONCLUSION

Barium sulphate (precipitated) is a good adsorbent even in very minute amounts. After adding an optimum amount of precipitated barium sulphate, further additions do not bring any remarkable change in iron contents.

REFERENCES

- [1] Kirk & Othmer Encyclopedia of Chemical Technology, (John Wiley & Sons, New York) Vol 2 (1978) 41,441.
- [2] Kirk & Othmer Encyclopedia of Chemical Technology, (John Wiley & Sons, New York) Vol 8 (1978) 540,612.
- [3] Kirk & Othmer Encyclopedia of Chemical Technology, (John Wiley & Sons, New York) Vol 18 (1978) 438,510.
- [4] Kirk & Othmer Encyclopedia of Chemical Technology, (John Wiley & Sons, New York) Vol 19 (1978) 424,431.
- [5] Shereve Norris R, Chemical Process Industries, 3 edn (McGraw hill book Company, New York) 1967.
- [6] Aimalohi Esechie¹, Perenlei Enkhbaatar², British Journal of Pharmacology (2009), 158, 1442-1453.
- [7] Mitchell J, Best N, Sundstrom LE, Wheal HV. PMID:8468197, [PubMed - indexed for MEDLINE], Histochemistry. 1993 Jan;99(1):91-4.
- [8] Kirk & Othmer Encyclopedia of Chemical Technology, (John Wiley & Sons, New York) Vol 1 (1978) 25, 421,460.



- [9] Perry Roberts H & Chilton Cecil ,Chemical Engineers Handbook,5 edn (McGraw Hill) 1973 .
- [10]IS 297;2001 Specification for sodium sulphide-technical (Indian Standards Institution,New Delhi).
- [11]IS 915 ; 1975 Specification one mark volumetric flasks (Indian Standards Institution,New Delhi).
- [12]IS 4161;1975 Specification for Nessler Cylinders (Indian Standards Institution,New Delhi).
- [13]IS 1997;1982 Specification for Buretts (Indian Standards Institution,New Delhi).
- [14]A. I. Vogel, Quantitative Inorganic Analysis, 3rd ed., Longman, (1966)