CHAPTER I

GENERAL INTRODUCTION

I.1 INTRODUCTION

Sulphur, along with coal and petroleum, forms the basis of the present chemical industries. Hence, conservation of these native resources by exercising economy in consumption and also by evolving suitable substitutes is all but necessary. This desideratum has been fulfilled to a large measure in regard to coal and petroleum. But in the matter of sulphur we had been utterly indiscreet, until in 1950[1] it was unequivocally proved by an exhaustive survey on the total global reserve of fairly pure and accessible native sulphur (i.e. brimstone), that enormous depredations on this stock had already been made. Not only our optimistic impression, that the nature's depository of elemental sulphur was virtually inexhaustible, was thus belied but a serious warning that the shortage of sulphur would be more acute in the near future (due to the unabated proliferation of the end-uses of the sulphur compounds) was also sounded. The gravity of the situation can be gauged from the soaring price of sulphur. The total output of sulphur has always been falling short of the demand by a wide margin all these years.

Alternative Sources and Methods of Recovery

The current global shortage of sulphur has initiated widespread research on the various existing as well as contemplated methods[2] utilising the different sources of sulphur,

either natural-occuring minerals or waste products of industries. The following are precisely the materials which are either in current use or ensure future promise[3,4,5]:

1. Natural sulphide ores : Iron pyrite or marcasite(FeS_2), pyrrhotite (Fe_nS_{n+1}, $n \geqslant 5$), chalcocite (Cu_2S), covellite(CuS), galena (PbS), chalcopyrite or copper pyrite ($CuFeS_2$), zinc blende (ZnS).

2. Natural sulphate ores : Anhydrite ($CaSO_4$), gypsum ($CaSO_4$, $2H_2O$), kieserite and epsom salt (anhydrous and hydrated $MgSO_4$ respectively), barytes or heavy spar ($BaSO_4$), anglesite ($PbSO_4$), celestite ($SrSO_4$).

3. Industrial gases : Roaster or smelter gas (produced by burning natural sulphides or sulphates), coal gas, water gas, producer gas and natural gas.

4. Industrial wastes : Spent acid streams like petroleum refinery sludge, alkylation sludge, pickle liquor and phosphogypsum (recently utilised).

Recovery of sulphur from industrial gases is necessary not only for making up the shortage of sulphur but also for preventing pollution hazards. It has been estimated that in the U.S.A. alone, more than 20 million tons of sulphur dioxide(nearly 1.5 times of sulphuric acid produced) are released to the atmosphere annually[6]. Large quantities of sulphur dioxide, hydrogen sulphide and organic compounds like carbonyl sulphide, carbon disulphide, thiophenes, mercaptans etc., are obtained from