

CHAPTER 1 INTRODUCTION

Phillips Petroleum (USA), one of the leading manufacturers of sulphur chemicals in the world, together with a South African affiliate, in 1983 started a research group at PU for CHE to develop and test collectors based on thiols (mercaptans) instead of alcohols. The effect of the third sulphur atom in the structure of short chain ionic trithiocarbonates (TTC's), compared to the dithiocarbonates (DTC's) was one of the main objectives of Slabbert (1985). The effect on bulk flotation efficiency was evaluated in his work. At that time Slabbert (1985) reported that a two percent increase in platinum recovery would yield a revenue increase of over R100 million per annum.

The work done by Slabbert (1985), Janse van Rensburg (1988), Coetzer (1987) and Steyn (1997) proved that the interaction between the collector molecule and water dictate flotation behaviour. The oxygen and nitrogen functional groups, relative to the sulphur atom, were found to be detrimental to flotation. Davidtz (1995) proposed a relationship between the Gibbs Excess Free energy of collector/water interaction at the mineral interface and flotation activity. The group contribution program, UNIFAC, was used to calculate activity coefficients of the functional groups of the different collectors in water and TTC's were calculated as the best collectors possible from Excess Gibbs Free Energy (G^{ex}) interaction calculations. A linear relationship was found between G^{ex} for the binary system collector/water and flotation activity. A basic principle of flotation based on a thermodynamic property was suggested, applied and tested on a large number of systems (Davidtz, 1998b).

Consistently higher grades and recoveries of base minerals was found, but research terminated with sanctions imposed on South Africa. In 1995 with the support of Gencor

and Chemfit Mining chemicals, the program was reactivated and a substantial amount of iC_3 -mercaptan was locally available. Large scale TTC's were synthesised by alternate routes and again tested at Impala Platinum (Steyn, 1997). Again the chemicals proved industrially promising, but some lingering problems of handling persisted.

It was time to extend the research beyond the bench scale level because batch flotation results on small cell are often questioned as representative of plant operation. A 60 litre continuous cell at Impala Mineral Processes was used to compare TTC's with the DTC/DTP standard mixture.

Furthermore, very little if any public information is available on some physico-chemical properties of TTC's as compared to DTC's. The work to follow addresses these issues as well.