CHAPTER I

INTRODUCTION

After the discovery that thorium can be made into a fissionable form through irradiation and is consequently an important source of nuclear power, economical methods for the recovery of this metal from its ores have attracted much attention. The metal itself is widely distributed in nature but rich deposits are scarce. It is the major constituent of thorite ($ThSiO_4$) and thorianite $(Th,U)O_2$; but due to the scarity of these minerals, little commercial thorium is derived from them. At present, the most important source of thorium is monazite, the phosphate of the cerium rare earths, containing varying amounts of thorium, whose usual accepted chemical formula is $(Ce, La, Y, Th)PO_4$.

Monazite is a minor constituent of pegmatites, granites and gneisses. The natural process of erosion concentrates the monazite in placer deposits, principally along river beds or beaches, where it is associated with other minerals such as ilmenite, magnetite, garnet and zircon. It is a red, brown or yellow, translucent mineral, forming monoclinic crystals which have a conchoidal fracture showing a resinous lustre. It has a specific gravity of 4.9 - 5.3, a refraction index of 1.786 - 1.837 and a hardness of 5.0 - 5.5.

Most of the monazite deposits in Thailand are in the Southern part between latitude $7^{\circ}45'$ -$9^{\circ}10'$ north (1). The mineral is produced as a by-product from tin-mines. Since uranium, thorium and rare earths found limited use in the local market, little attention has been paid to the mineral. Consequently, the mineral is produced in very low rate and is exported with prices that are based on the content of rare earths only. The thorium oxide (ThO_2) content of the local monazite varies between 1 and 15 per cent with an average at about 4 per cent , whereas the rare earths content reaches about 50 per cent. Monazite in high concentration was also found in beach sands from some areas of Southern Thailand. A programme for surveying the contents of monazite in beach sand is being planned by the Department of Mineral Resources (2).

Realizing the strategic importance of this mineral, a study programme directed towards obtaining detail informations of a process that could be adapted industrially to the processing of domestic monazite for thorium, uranium, rare earths and the contained phosphate was initiated by the Office of Atomic Energy for Peace (OAEP) in the early of 1973. The present work which is the first part of series of investigations, covers the Laboratory studies of the two major monazite opening processes, e.g., the methods using caustic soda and sulphuric acid, followed by the purification of thorium by solvent extraction. The amount of monazite used for one digestion varied from 0.5g to 50 g. This investigation supplements other works that are

being performed in the OAEP in providing information on the feasibility of monazite processing for uranium, thorium and rare earths in the country.