UNIVERSITI TEKNOLOGI MARA

PHYSICAL SEPARATION OF HEAVY MINERALS FROM `AMANG` AND THE RECOVERY OF CERIUM, GADOLINIUM AND EUROPIUM ELEMENTS FROM MONAZITE SAMPLE VIA SOLVENT EXTRACTION

NOR MONICA AHMAD

Thesis submitted in fulfillment of the requirements
for the degree of
Master of Science

Faculty of Applied Science

December 2009

Candidate`s Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledge as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

In the event that my thesis is found to be violating the condition mentioned above, I voluntarily waive the right of conferment of my degree and agree to be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

Name of candidates:	Nor Monica Binti Ahmad
Candidate`s ID No:	2007254324
Programme:	Master of Science
Faculty:	Applied Sciences
Thesis Title:	Physical separation of heavy minerals from `amang` and the recovery of cerium, gadolinium and europium elements from monazite sample via solvent extraction

Signature of Candidates ..... Monica .....

Date ..... 16/12/2009 .....

ABSTRACT

Some of the rare earth elements play important roles as phosphors. These phosphorous elements have a wide application in industries. In the present study, the focus is to find the extraction parameters in order to extract the rare earth elements in heavy minerals from `amang` using solvent extraction method. `Amang` samples were collected from ex-mining area in Kg Gajah, Perak and subjected to the wet gravity separation, drying process and then magnetic separation. Results show that samples from location A21 and A42 contain the highest amount of monazite minerals. For confirmation, those samples were analyzed for its morphology and elemental content using SEM/EDX. Samples from Kg. Gajah were compared with samples from Beh Minerals Sdn Bhd. the 'amang' processing factory near Ipoh, Perak. EDX spectra, both samples show some similarity. Extraction parameters using standard rare earth elements show that the best conditions for both cerium and gadolinium using n-heptane as diluents are at pH 3.2, within 15 minutes equilibrium time and at pH 2.7 within 15 minutes equilibrium time, respectively. On the other hand, europium demonstrates the highest percent of extraction at pH 2.2, within 15 minutes equilibrium time using toluene as diluents. Monazite sample from two different places that is from Kg. Gajah and Beh Minerals Sdn Bhd were subjected to the extraction procedure using the best extraction parameters for the respective individual elements of interests. Result from the duplicate samples show that the percentage of extraction for cerium, gadolinium and europium in monazite samples from both places are between 53 % to 92 %. Cerium recovered from Kg Gajah and Beh Minerals Sdn Bhd is 82.84 % and 76.41% respectively. Gadolinium recovered from Kg Gajah and Beh Minerals Sdn Bhd is 91.97 % and 81.25 % respectively. Europium recovered from Kg Gajah and Beh Minerals Sdn Bhd is 63.52 % and 53.53 % respectively. Analysis using FTIR spectrometry for the organic phase confirmed the occurrence of ion exchange in the phase.

TABLE OF CONTENT **Page**

CHAPTER 1

INTRODUCTION

This chapter provides the background and the rationale of the study. The overview describes the existence of the heavy minerals within the raw samples containing `amang`, the history of `amang` existence in the study area, the history of the effort to reveal the better separation method in order to extract rare earth elements, significance of the study as well as the objective of the study. Not to mention, the problem statement also will be discussed in this chapter.

1.1 Background of the Study

Ex mining areas contained minerals which will be economically beneficial to the mineral related industries. Previously, other researcher found that beach sand (Worobiec *et al.*, 2007) and rock (Walsh, 2007) are mineral resources other than ex mining area. A mineral is a naturally occurring substance formed through geological processes that has a characteristic chemical composition, a highly ordered atomic structure and specific physical properties. Heavy minerals refers to minerals with a specific gravity greater than that of quartz (Reyneke *et al.,* 2001). Some examples of heavy minerals are monazite ([Ce, La, Nd, Gd, Th] PO_4), zircon ($ZrSiO_4$), ilmenite ($FeOTiO_2$), xenotime (YPO_4) and struverite ($Nb.Ta.TiO_2$) which have various uses in minerals industries.

Nowaday, 'amang' which is taken from ex-mining area is becoming more important since we can recover valuable heavy minerals from it. `Amang` is a widely accepted term in Malaysia for the heavy mineral rejects which remain after tin oxide (cassiterite)