Chapter II

LITERATURE REVIEW

2.1 Oil Shale

Oil shale is a fine-grained sedimentary rock with a laminar structure quite similar to slate. Its colour varies from gray or bluish gray to brown or almost black, and there is little outward appearance or feel of oiliness. However, rich, thin pieces can be ignited with a match and will burn with a sooty flame and petroleumlike odour. The shale is composed of a solid organic material known as "kerogen", derived by combining two Greek words meaning "producer of wax" (1).

Kerogen is intimately associated with a mixture of minerals that in most oil shale, make up a predominant share of the rock. Kerogen is an insoluble coal-like meterial with an empirical formula approximating $C_{200}\ H_{300}\ S\ H_5\ O_{11}$ (2). It undergoes a chemical transformation from 450 ° to 550 °C. to give a major pyrolysis product of oil; secondary products are gas and a carbonaceous residue which remains associated with the inorganic matter. Shale oil obtained in this manner is a mixture of hydrocarbons and hydrocarbon derivatives containing oxygen, nitrogen, and sulfur. By appropriate processing tech-

There are several processes for the recovery of shale oil from raw shale. Among these, fluidized-bed retorting seems to be an efficient process because fluidization has many advantages as follows :

1. uniform temperature of the solids in both horizontal and vertical directions.
2. uniform solids and gas distribution.
3. intimate solid-gas contaction providing easy heat and mass transfer between gas and solids.
4. convenient solids handling
5. large surface area per unit weight of solids for heat and mass transfer and
6. rapid transportation of the evolved product from the fluidized bed.

Generally, for a continuous process, a fluidized-bed retort is a vertical vessel equipped with shale and gas distribution devices such as screw feeder and gas-distributor. It is divided into four functional zones, as follows : product cooling zone, retorting zone, combustion zone, and heat recovery zone. Crushed and sifted shale moves downward as a bed through the retort vessel, passing through the product cooling zone where the solid particles are heated almost to retorting temperature while the rising gases from the retorting zone are being cooled. The shale then passed down-

ward through the retorting zone where kerogen in the shale is decomposed to liberate oil vapor and gas. Spent shale is burnt in the combustion zone to sustain heat for the process, it is combined by the heat of recycle gas combustion. From here the spent shale moves down through the heat recovery zone where it is cooled by a rising stream of recycle gas. The cooled spent shale is discharged from the retort vessel. The gas stream leaving the retort first passes through oil most separators to recover the shale oil and then enters a blower to increase flow rate.

The advantages of fluidized-bed retorting combined with the fact that there has been no experimental work on Thai oil shale using fluidization technique, are the criteria of choosing this technique to study the effect of retorting temperature and particle size on oil yield. The major oil shale deposit in Thailand is Mae Sot deposit at Mae Sot district in Tak province. Therefore, Mae Sot oil shale may be the better representative of Thai oil shale.