Chapter VI

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

There has been no literature concerning the fluidized-bed retorting of oil shale in Thailand. Oil shale retorting by a batch of solids fluidization method was decided to be the process of this experiment, using nitrogen gas as fluidizing medium. Mae Sot oil shale was selected to be the sample. The equipment design of 100 gm. retort was included in this work. The experimental equipment was arranged in such a way that it was easy to operate and convenient to measure the variables. The purposes of this work were to study the effects of the retorting temperature and the oil shale particle size on the oil yield.

The advantages of fluidized-bed retorting for oil shale, as discussed in Chapter V, result in maximum oil yield attainable. The oil yield is greater than that obtained by the Fischer assay methods.

By controlling the nitrogen velocity at minimum fluidizing velocity, it was found that the retorting temperature from 550 °C to 580 °C and the mean particle size of oil shale from 0.500 to 0.576 mm. gave maximum oil yield of about 107.05

weight percent of Fischer assay.

6.2 Recommendations for Further Study

The experiment, described in the previous pages, is only the first step to fluidization application to oil shale retorting in a laboratory scale. This method is presently considered to be the appropriate one.

In general, the process for recovery of shale oil from oil shale in a fluidized-bed retort can decrease the cost of production, because there are by-products and the excess heat that may be further utilized. For instance, the gas stream leaving the oil recovery equipment is divided into two seperate streams, one stream may be injected with air into the retort as the fluidizing gas, and the remainder may be vented from the system to be used as product gas. Besides, the spent shale may be withdrawn from the retorting zone and burned to generate heat. The amount of energy may be recovered by preheating cold gaseous fluidizing medium, cold raw shale and other systems in the process. The excess heat may also be used to generate electricity. Moreover, the burned spent shale may find its outlet as a construction material.

Nevertheless, additional information is essential in order to develop fluidization for large scale production. The recommended future investigation are listed below :

1. Analyses of shale oil to study the effect of retorting temperature and the fluidization technique on its quality.

2. The effect of other fluidizing gases such as CO_2 and H_2, because both would result in an increase in product yields as suggested by Reyburn (20) and Hemminger (18).

3. The effect of the fluidizing gases on the properties of shale oil and gas, because some gases could change the characteristics of the products.

4. In better designing of a fluidized-bed retort, the diffusivity of kerogen must be known, because the decomposition of kerogen within oil shale pores seems to be diffusion control (17).

5. Continuous process laboratory scale design and test run to study the effect of residence time of raw shale on oil yield.

6. The effect of flow rate of fluidizing gas on oil yield for continuous process.

7. Heat requirement for Mae Sot oil shale retorting and heat recovery from retorting gas and spent shale.

8. A continuous fluidization process for pilot scale production including feasibility study, and preinvestment.