CHAPTER VIII
CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

This research project has been successful in determining the factors affecting the scale inhibitor precipitation squeeze treatment. The experimental results showed that the quantity and properties such as dissolution rate of scale inhibitor precipitate were governed by the solution pH, type of inhibitor, concentration, solution ionic strength and the presence of impurity. A salting out effect was observed for the precipitation of scale inhibitor. A smaller amount of inhibitor precipitated is a result of an increase in Mg-inhibitor complex in the solution. The dissolution rate of inhibitor precipitates decreases significantly with an increasing molar ratio of divalent cation to inhibitor in the precipitates. The solution pH plays an important role on controlling the precipitation kinetics of scale inhibitor. The addition of impurities inhibits the nucleation of inhibitor precipitation. The reduction of precipitation rate is a result of increasing the surface free energy. The results indicate that Ca-ATMP system has a longer squeeze lifetime than Ca-DTPMP systems. The concept of a measured critical supersaturation ratio, the CSSR was developed to characterize the effectiveness of the scale inhibitor in terms of type, concentrations and solution pH for $BaSO_4$ inhibition.

8.2 Recommendations

The fundamental understanding of the precipitation squeeze treatment processes provided the basis for the design of the treatments with enhanced squeeze lifetimes, i.e. the solution pH control, better scale inhibitor placement, i.e. the addition of Mg ions to delay the precipitation of scale inhibitor, and led to the development of a mathematical model. However, to further the understanding of precipitation squeezes recommendations of other scientific and intellectual issues are addressed here. Other types of scale inhibitor such as polymeric type, i.e. PPCA are

worthwhile to investigate similar to the study done here with ATMP and DTPMP to obtain a better fundamentally understanding of the precipitation and subsequent dissolution rate. The fundamental precipitation under two-phase conditions, and the presence of impurities such as sand or zeolite must be studied to account the complicated phenomena often observed in oilfields. The development of the precipitation squeeze treatments mathematic models are extremely useful in designing of more efficient treatment procedures. The transformation reactions of scale inhibitor precipitates are the important issues to enhance the squeeze lifetime of treatment. Our preliminary experiments found the possibility to transform 1:1 Ca-ATMP precipitate to 2:1 Ca-ATMP precipitate which provided a slower dissolution rate. The reliable scale inhibitor placement technique need to be developed to ensure inhibitor precipitation without formation damage.