



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The batch BaSO_4 precipitation experiments in the absence and presence of scale inhibitors including ATMP, DTPMP, and PPCA were studied. The concept of a critical supersaturation ratio was defined to characterize the effectiveness of the scale inhibitors on the inhibition of BaSO_4 scale formation. The critical supersaturation ratios were subsequently obtained under various conditions. The SEM, EDS, and particle size distribution analysis of the forming BaSO_4 precipitates were also comparatively studied. The conclusions drawn from the experimental results are as follows:

1) In the presence of the scale inhibitors, the critical supersaturation ratio decreased with increasing the testing time until reaching a virtually constant value. On the contrary, the critical supersaturation ratio in the absence of the scale inhibitors continuously and gradually decreased until reaching the value of solubility product.

2) The scale inhibitors had a significant effect on the critical supersaturation ratio, the morphological structure, and the particle size of the BaSO_4 precipitates.

3) The higher the scale inhibitor concentration, the more effective the BaSO_4 inhibition was obtained, as manifested by an increase in the critical supersaturation ratio with increasing the scale inhibitor concentration.

4) The critical supersaturation ratio was suitably expressed as a linear function of the logarithm of the scale inhibitor concentration.

5) The higher the initial solution pH, the more effective the BaSO_4 inhibition was obtained, resulting from an increase in the critical supersaturation ratio with increasing the initial solution pH.

6) The critical supersaturation ratio varied linearly with the initial solution pH.

7) The addition of the scale inhibitors resulted in the smaller and more spherical BaSO_4 particles than in the absence of the scale inhibitors.

8) Increasing scale inhibitor concentration and initial solution pH also resulted in the smaller and more spherical the BaSO_4 particles with broader particle size distribution and smaller mean diameter of those particles.

9) PPCA, which contains twenty five ionizable protons, was more effective for the BaSO_4 scale inhibition than either DTPMP or ATMP, which possess ten and six ionizable protons respectively, because PPCA provided not only the higher critical supersaturation ratio, but also the smaller BaSO_4 particles and less amount of BaSO_4 precipitates.

5.2 Recommendations

The actual conditions in most oilfield reservoirs are subject to the influences of many divalent cations such as calcium and magnesium in high quantities and at high temperature which are the important factors potentially affecting the capability of the scale inhibitors on the BaSO_4 inhibition. To attain more reliable and precise results, the effect of these significant factors should be further investigated.

Additionally, there are many kinds of scale inhibitors currently used to efficiently prevent many scaling problems. The use of other scale inhibitors or a mixture of two or more scale inhibitors should be methodically examined to obtain innovative results.

Moreover, an imitated porous media such as coreflood apparatus should be utilized to perform the dynamic system for being close to actual situation in reservoirs.