CHAPTER I

INTRODUCTION

Nowadays, Petroleum production system have faced the problem of scale deposition. For example, a substantial number of wells in the Prudhoe Bay field have been damaged by the deposition of calcium carbonate scale in the perforation tunnels and near-wellbore matrix. Although the produced water in many reservoirs contains mixtures of dissolved ions that are unstable with respect to precipitation, the condition favorable to the formation of scale is created by the sudden changes in produced fluid conditions such as temperature, pressure and pH or by the mixing of incompatible formation and injected brines. If left unchecked, continuous scale buildup can reduce the production efficiency of a reservoir and damage the production equipment. These can cost producers millions of dollars in terms of the loss of productivity and maintenance expense.

One of the most effective ways to solve this scaling problem is through the use of chemical scale inhibitor applied in "squeeze" treatments. In this process, a small volume of scale inhibitor solution along with brine overflush is injected into the formation. Then, a reservoir is shut-in for approximately twenty-four hours in order to allow the inhibitor to retain in the formation. The inhibitor is retained in the porous matrix by adsorption onto the surface of rock reservoir and/or by forming a sparingly soluble salt with calcium. In addition, the inhibitor can be trapped in small fractures. After shut-in period, normal production is resumed and the scale inhibitor is slowly released back into the production water (see Figure 1.1). When the concentration of the inhibitor drops below the level which is effective to prevent the formation of scale, the

production has to be shut down and the reservoir must be retreated. Therefore, the success of a treatment process is usually determined by the period of time in which the scale inhibitor is released back at the effective concentration.

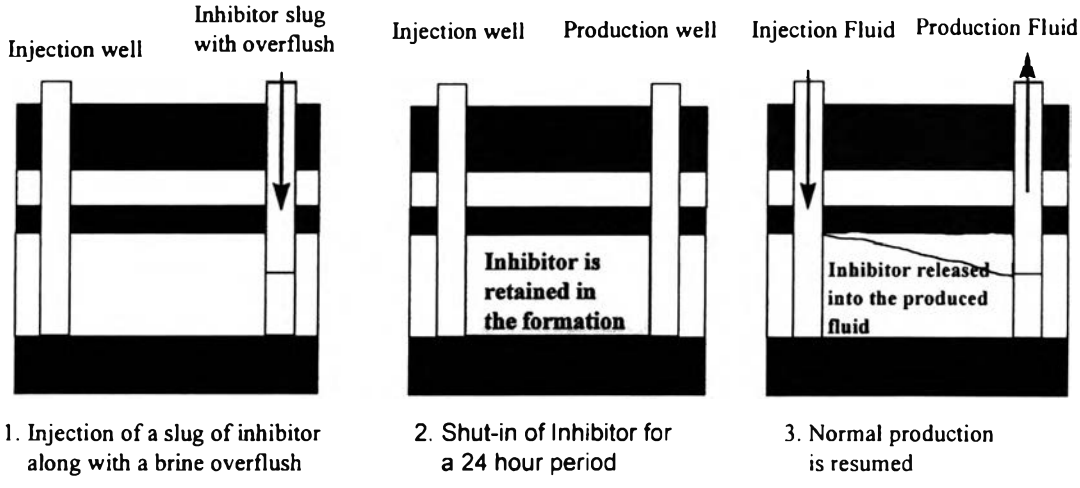

Figure 1.1 Schematic of typical squeeze treatment process (Browning, 1996).

Ideally, the release of inhibitor should take place at a minimum effective concentration and should last for months. However, in an actual treatment, much of the scale inhibitor initially release rapidly into the produced fluid following by the quick drop of the inhibitor concentration (see Figure 1.2). As a result, another squeeze treatment is required in a matter of a few weeks.

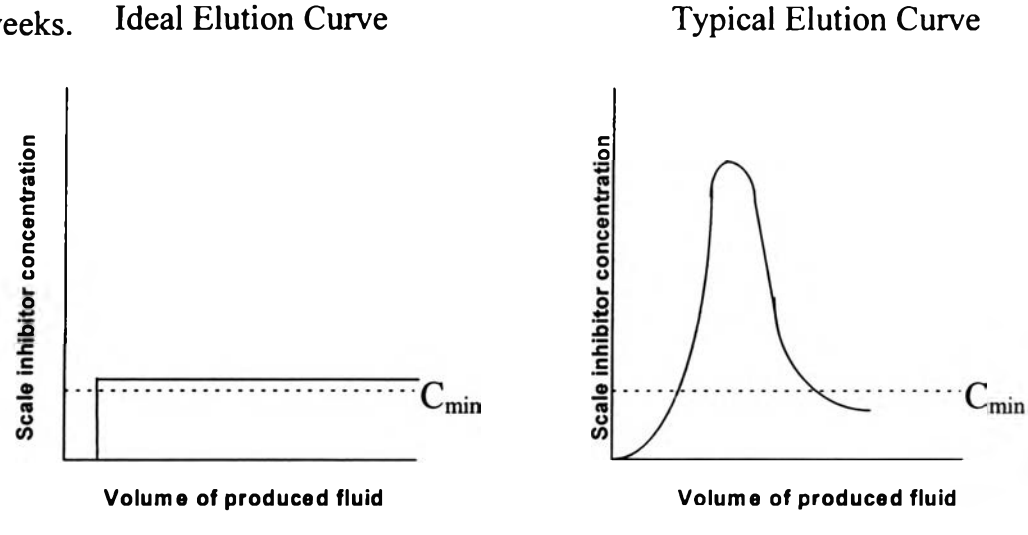

Figure 1.2 Comparison between an ideal and typical elution curve (Browning, 1996).

Therefore, It is important to design squeeze treatment where the scale inhibitor is slowly released from the porous media providing the satisfactory long treatment lifetime. The fundamental understanding of the retention/release mechanisms of inhibitor from porous media will aid in achieving this desirable squeeze treatment process.

The focus of this work was to study the characteristics of the distinct calcium-phosphonate precipitates and to elucidate the factor that affect the dissolution process governing the release of calcium phosphonate precipitates in porous media.