CHAPTER I
INTRODUCTION

Chromium is a heavy metal that is widely used in many industries such as electroplating, manufacturing of dyes, ink or paint pigments, tanning process, and adding to cooling water for corrosion control. Most of chromium is in a form of hexavalent chromium or chromate. Both hexavalent and trivalent chromium naturally exist in the environment. Chromate is toxic and known as a human carcinogen and mutagen. Since it is soluble in water, it is highly mobile in aquatic system resulting in dissolution of nature soil mineral and precipitate new phase of $KFe_3(CrO_4)_2(OH)_6$ and $KFe(CrO_4)_2.2H_2O$ (Baron et al.,1996). Trivalent chromium is considerable nontoxic and is a essential trace metal in human nutrition. The reduction of hexavalent to trivalent chromium in contaminated water and soil have been studied (Hug and Laubscher,1997), because chromate contamination affects aquatic life and human health.

A commonly used technique to remove toxic heavy metal ions from wastewater is a batch process which those ions are precipitated by adding lime (Ministry of industries,1996). The chromium (VI) ion can't be precipitated directly in this process. It must be reduced to trivalent chromium by the addition of ferrous sulfate and acidic sulfite and subsequently precipitated trivalent chromium as hydroxy chromium by adding lime. This process can be a high cost operation, because it requires the addition of chemicals and multiple operating steps. Furthermore, it produces a large volume of sludge.

Polyelectrolyte is added to polluted aqueous stream to enhance separation of chromium (VI) ions in an ultrafiltration process (Christian et al.,1990, Amajad, 1990, Volcheck et al.,1993). Ultrafiltration is a membrane process capable of retaining solutes as small as 1000 daltons (Roussean,1987). Chromium (VI) ions bind to soluble polyelectrolyte of opposite valence and the solution is treated with ultrafiltration the pore size small enough to reject the polymer (Tabatabai, 1995). Sriratana et al. studied polyelectrolyte-enhance ultrafiltration (PEUF) process using a cationic polyelectrolyte, poly(diallyldimethyl ammonium chloride), to remove divalent ion chromate. They demonstrated that 99% of chromate ions were rejected by 0.3 M QUAT concentration (Sriratana et al.,1996). To produced free QUAT, the divalent cation of barium was added to precipitate chromium (VI) as a compact waste of barium chromate (Chaisin,1997, Tucker et al.,1992).

This work was focused on the equilibrium precipitation of chromate with barium with QUAT in a retentate solution from PEUF. A crystallizer was designed to allow barium chromate particles to settle and produce a polyelectrolyte-rich supernatant stream. The QUAT-chromate complex solution which was in the retentate of PEUF process was operated in the crystallizer.