CHAPTER I
INTRODUCTION

With the combination of an increase in world energy demand and the decline of conventional oils, heavy crude oils, which are rich in asphaltenes as well as low fraction of light molecular weight components, have been considered as relevant hydrocarbon resources for use in the near future. Even though heavy crude oils are counted for a large fraction of recoverable oil resources, a small portion is produced during an oil production owing to their high viscosity (Martínez-Palou, 2011).

There are three conventional approaches for transportation of heavy crude oil: viscosity reduction, drag minimization and in-situ oil upgrading. Among these techniques, one commonly used technique for viscosity reduction is to transport viscous heavy crudes as oil-in-water emulsions stabilized by surfactants. In an oil-in-water dispersion, the oil phase becomes dispersed in the water phase and the viscosity of the oil-in-water dispersion is close to the water (Abdurahman, 2012; Ashrafizadeh, 2010).

Wax deposition in subsea pipelines is a common issue during the transportation of waxy crude oil. Temperature of crude oils decreases due to heat loss to the surrounding environment. Radial temperature gradient from the fluid to the environment could cause decreasing in wax solubility, leading to wax precipitation and adsorption on the pipeline surface. The near wall region is thus depleted of dissolved wax compared with the bulk fluid. The dissolved wax concentration gradient and flow will cause wax molecule to convectively transport to the deposit surface and grow up the deposit (Huang, 2011; Sarica, 2012).

Most oil fields produce water along with oil. Consequently, the turbulent flow of crude oil/water can form oil-in-water emulsion with existence of natural surfactants. In addition, practical techniques to facilitate heavy crude oil transportation as mentioned above involves an artificial formation of oil-in-water emulsion (Martínez-Palou, 2011). However, the paraffin deposition process is not well understood for oil/water dispersed flow conditions. Several researches have been investigating the wax deposition characteristics of two-phase oil/water flow

conditions, including stratified, dispersion of water in oil, and dual dispersion. Nevertheless, only a few wax deposition studies in oil-in-water dispersion flow have been investigated and the wax deposition possibility hasn't been confirmed (Couto, 2008; Bruno, 2008).

The purpose of this work is to assess the possibility of wax deposition in oil-in-water dispersed flow using a cold-finger apparatus. Wax deposit will be formed on a cold surface which simulates the virtual subsea pipeline condition. Oil-in-water emulsion used in this study was prepared using mineral oil as the oil phase with the aid of Triton X-100 at concentration of 5wt% based on the total mass on an emulsion (Abdurahman, 2012; Ashrafizadeh, 2010). The deposition rate of oil-in-water dispersed flow will be obtained at various operating conditions. Deposit composition will be analyzed with gas chromatography.