CHAPTER I
INTRODUCTION

Nowadays, the world faced the climate change resulting from greenhouse gas such as CO_2, N_2O, and CH_4. Carbon dioxide is the significant greenhouse gas coming from many difference sources. The most striking sources of emission are burning of fuel from industrial area (Songolzadeh and Soleimani *et al.*, 2014). It is important to be able to control emission of CO_2 into the air. However, CO_2 capture and separation are used various technologies such as membrane separation technology, absorption technology (Hamborg *et al.*, 2011), adsorption technology, and cryogenic distillation (Somy et *al.*, 2009). Although aqueous amine absorption is widely used for CO_2 absorption, it has some problems, namely corrosion, oxidation degradation, and using high energy to generate (Jiang *et al.*, 2011). Furthermore, cryogenic distillation has several drawbacks, such as a lot of costly step required to remove all water (Barbieri *et al.*, 2011). To avoid these problems, material prepared by high internal phase emulsion (HIPE) has been suggested as one of the material used for the application since, as it contains high porosity, surface area, and high thermal degradation (Pakeyangkoon *et al.*, 2008).

PolyHIPE can be prepared by high internal phase emulsions (HIPE), polymerization of an organic phase and an aqueous phase under mechanical stirring. PolyHIPE obtains high porous material containing the internal aqueous phase 74 to 90 percent of total volume (Cameron *et al.*, 2005). Accordingly, polyHIPE has good properties, such as high surface area (up to 700 m^2/g), low bulk density (less than 0.03 g/cm^3), high porosity (over 90% of total volume), and open cell structure (Silverstein *et al.*, 2005). PolyHIPE are able to apply in widely applications; for example, tissue engineering, biotechnology, separation filtration, and CO_2 absorption.

The amine group is used to modify on polyHIPE surface for CO_2 adsorption because CO_2 absorption efficiency can be obtained both reactions, the physical reaction of surface area of polyHIPE and chemical reaction of amine group. The physical adsorption of CO_2 on porouse materials, for instance, polyHIPE (Pakeyangkoon *et al.*, 2008), activated carbons (Rashidi *et al.*, 2013), and porous silica (Qi *et al.*, 2011). Another method is chemical adsorption using amine functionalized onto porous materials, such as tetraethylenepentamine (TEPA) /diethanolamine (DEA) (Yue *et al.*, 2008), polyethyleneimine (PEI) (Martín *et al.*, 2014), diisopropanalamine (DIPA) (Plaza *et al.*, 2008), and piperazine (PZ) (Saiwan *et al.*, 2014). The chemical reaction of amine and CO_2 is to from carbomate during reaction of primary and secondary amine. Nevertheless, amine impregnated inside porous material can aggregate, leading to lower surface area. To solve this problem, layer-by-layer (LbL) technique using amine solution has been developed on polyHIPE. The LbL technique consists of polyanions and polycations on porous materials leading to multilayer flims. In addition, LbL technique has a washing step that remove residue material which prevents pore plugging.

This research polyHIPE preparation was carried out and layer-by-layer (LbL) technique was used to increase CO_2 absorption of the material. PolyHIPE was prepared from divinylbenzene (DVB) and styrene (S) using water in oil system. Then, solution was applied within polyHIPE using LbL technique. Positive charged polymers were polyethylenimine (PEI), tetraethylenepentamine (TEPA) and poly(diallyldimethylammonium chloride) (PDADMAC). Negative charged polymer was polystylene sulfonate (PSS). Finally, polyHIPEs were characterized by scanning electron microscope (SEM), Autosorb-1MP (Quanta chrome), Universal testing machine (Lloyd), Differential Thermal Analysis (TG-DTA), and Gas Chromatograph with Thermal Conductivity Detector (GC-TCD).