CHAPTER I
INTRODUCTION

The emission of hydrophobic volatile organic compounds (HVOCs) from the petrochemical industry causes several environmental problems and health concerns. Since the HVOCs are suspected to be carcinogenic and mutagenic substances, even at very low concentration, a HVOCs treatment process is required to separate the HVOCs from the contaminated solution before discharging to a public water reservoir. Surfactant-based separation techniques have been proposed to economically eliminate these HVOCs since they are more effective in terms of both separation efficiency and energy than conventional techniques. Moreover, surfactants are generally more environmentally friendly than other conventional solvents utilized in liquid–liquid extraction.

However, it could be seen that using surfactant to remove HVOCs from wastewater could produce high concentration of surfactant containing HVOCs. The method that uses to remove HVOCs from wastewater by using surfactant is cloud point extraction process (CPE). In some research found that more than 90 percent surfactant was in coacervate phase of the cloud point extraction techniques. Therefore, it is necessary to have another step to support in order to reuse the surfactant, which will make the process more economic attractive.

Generally, the separation technique of HVOCs from the aqueous solution could be done by many methods, for example, air stripping chamber, steam stripping chamber, and spraying. These methods are highly effective and can be widely applied, for example, air stripping chamber is used to treat drinking water, wastewater and groundwater. Most of the chambers, the vapor flow in opposite direction of the liquid resulting in high efficient of convection. In the part of steam stripping chamber, it is often used by applying the waste steam from other production processes, which help to reduce production cost. In addition, this technique could be operated in small scale comparing to the air stripping chamber. The spraying is normally used to remove the HVOCs from water, since it contains high surface area and transfer rate. However, if all of the above mention methods

are applied to remove the HVOCs from surfactant solution. The counter current flow of vapor and liquid inside the chamber can cause excessive foaming leading to overflow and failure in most applications. Moreover, as the surfactant is water soluble compound, using steam may require the subsequence separation of surfactant from contaminated water.

Vacuum stripping has been widely used for HVOC removal from contaminated water in chemical and petrochemical industries, such as the removal of butane and refrigerants from water in a desalting process, carbon dioxide and oxygen from water, HVOCs from water streams, and emulsified organic liquid from water. Generally, all of these processes are operated in counter-current mode because it provides a high mass transfer rate. In contrast, the mass transfer in a co-current process can be limited as a maximum of one transfer unit is possible before equilibrium is reached between the vapor and liquid phases. It was reported that the mass transfer coefficient of the counter-current flow in a packed tower was threefold higher than that of the co-current flow for carbon dioxide absorption into water; in general, co-current separation efficiency is lower than that of a counter-current separation, making the latter process much less popular. However, flooding and limited liquid loading were found to be limitations of the counter-current operation, especially in a process containing surfactants; thus, the co-current operation is suggested for use in recycling a contaminated surfactant solution.

Therefore, this research is aims to develop the packed column applying for separation of organic compounds from contaminated surfactant solution. The study will focus on the isolation of HVOCs in the group of aromatic and chlorinated hydrocarbons from the alcohol ethoxylates nonionic surfactant since the future trends in surfactant the AEs will be used more, due to its environmental friendly properties.