



CHAPTER 1

INTRODUCTION

Hydrochloric acid is a solution of hydrogen chloride (HCl) in water which is produced to use as raw material in chemical industries. Some of the hydrogen and chlorine gases from brine electrolytic process are sent to the hydrochloric acid synthesis unit where hydrogen gas is burnt in a chlorine atmosphere. The hydrogen chloride gas product is then cooled down and absorbed by deionized water resulting in hydrochloric acid solution of 35 % by weight concentration. Hydrochloric acid product are kept in rubber lined steel storage tanks before it is delivered to customers. In Thailand hydrochloric acid is widely used in industry in many fields as the pickling of metals for scale removal in metal industry, food industry, as monosodium glutamate production, cane-sugar refining, synthetic rubber production, production of glucose and corn sugar from starch, etc.

Pure hydrogen chloride is a colorless, pungent gas at normal temperatures and pressures. It fumes strongly in moist air and is toxic if breathed in concentrated form. It is highly soluble in water with the evolution of heat. Hydrochloric acid, although colorless when pure, is usually yellow due to the presence of iron, chlorine, or organic substances. Although the anhydrous form is noncorrosive, the aqueous solution attacks all the common metals. Because it is irritating to the skin and mucous membranes, contact with the gas or solution should be avoided. Hydrochloric vapor is toxic to human and environment, vapor absorption tower is required to prevent hydrochloric vapor to be emitted directly to atmosphere.

Normally for large volume storage, hydrochloric acid is stored in tank as rubber lined steel tank or fiberglass tank. For tank cracking protection, solution vapor pressure is relieved by venting but is not directly vented to atmosphere. Hydrogen chloride vapor from storage tank is scrubbed by water in absorption tower. In industry packed absorber is widely

used hydrochloric vapor because high corrosion resistance and high efficiency. Water is normally used as absorbent because of high solubility property and lowest cost.

At present the study of packed absorber for hydrochloric acid storage tank is not available in Thailand, packed absorber is sized by general method and by experience of designer. This thesis is established for conveniently and correctly packed absorber design procedure (sizing evaluation), packed absorber design program for hydrochloric vapor is also programmed. At first, energy balance for hydrochloric acid storage tank to prediction of vaporization rate from storage tank, physical properties of hydrochloric and water gas mixture, hydrochloric vapor absorption by water and steady-state mass transfer of hydrochloric vapor to water in packed absorption tower are studied, then the appropriate design procedure for packed absorber of hydrochloric acid storage tank is prepared. Computer program which consists new absorber sizing for hydrochloric acid storage tank, packed absorber simulation with data of inlet gas phase and packed absorber simulation without data of inlet gas phase is programmed.

Finally result from computer design program accuracy is verified by compared with result from existing packed absorber testing in plant. The program as result of this thesis could be use to design packed absorber for hydrochloric acid storage tank of Siam Occidental Electrochemical plant and design packed absorber for storage tank of hydrochloric acid customer.