# UNIVERSITI TEKNOLOGI MARA

# EFFECT OF FLOWRATE AND RESIDENCE TIME ON EFFICIENCY OF AMMONIA GAS REMOVAL


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# ABSTRACT


## EFFECT OF FLOWRATE AND RESIDENCE TIME ON EFFICIENCY OF AMMONIA GAS REMOVAL

Ammonia gas is an alkali gas which can causes various effects towards living organisms if these strong alkali gases are release to the environment without treated properly. The objectives of this research are to study the effect of flowrate and residence time on efficiency of ammonia gas removal. An optimum flowrate of inlet gases and the residence time for the reaction which is absorption process are essential or very important in conducting the contaminant gases absorption process because it will affect the efficiency of the alkali gas removal or the percentage of the alkali gas that have been absorbed. In this research, the analysis was conducted to study the efficiency of the ammonia gas removal by using different flowrate and residence time. The relationship or effect of the flow rate and residence time is shows in the graph. In this research the flowrate that were used is 1ml/min, 2ml/min, 3ml/min, 4ml/min and 5ml/min and the residence time are varies 2min, 4min, 6min, 8min and 10min. The ammonia is transfer into the scrubber with contain 200ml each solution at every experiment respectively. Therefore, based on this research, the most optimal efficiency removal of $NH_3$ gas is by using 1ml/min at 2 minutes. Moreover, at 2 minutes until 10 minutes of residence time, this flowrate still produce above 75% of percentage recovery of $NH_3$ gas which is at the higher recovery of $NH_3$ gas compare to others flowrate.

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# CHAPTER 1

# Introduction

## 1.1 BACKGROUND STUDY

Ammonia or known as $NH_3$ is a compound of Nitrogen (N) and Hydrogen (H) with a characteristic pungent smell and a colourless gas. $NH_3$ is very toxic an also flammable is a commonly produced in industrial with value of LEL 15% [1]. China is the prime worldwide producer in 2014 with 176 million tonnes which is nearly one-third of total production followed by India, Russia and also the United States [2].

$NH_3$ exists naturally in humans and the atmosphere and it is utilized in industry and commerce. $NH_3$ is a precursor for organic compound and ester synthesis and also important for several biological processes. $NH_3$ is made in soil from microorganism processes such as decomposition of organic matter, as well as plants, animals and animal wastes.

Within the presence of wet such as high relative humidity, the $NH_3$ gas is lighter than the air and can rise. The vapours that are produced by liquefied anhydrous $NH_3$ gas are heavier than air which increase the chance of exposure from leaks to massive $NH_3$ refrigeration plant.

High-concentration $NH_3$ is employed as a producing process gas for the production of compound semiconductors, like gallium nitride, however harmful gas emitted from production devices needs to be removed to a level below the threshold limit value (TLV), the safe level for the human body, in thought of the work surroundings. [3]. The exposure of $NH_3$ gas will lead to irritating to the eyes, throat, and breathing passages. Everything from gentle irritation to destruction of the eye will occur depending on whether a spray or gas is involved. $NH_3$ penetrates the eye faster than other alkalis [4]. In terms of inhalation, $NH_3$ may cause nasopharyngeal and tracheal burns, bronchiolar and alveolar edema, and airway destruction resulting in respiratory distress or failure and $NH_3$'s odor threshold is sufficiently low to acutely provide adequate warning of its presence (odor threshold = 5 ppm; OSHA PEL = 50 ppm) [5]. There are a few methods to remove $NH_3$ gas. Figure 1.1 show the general scrubber system which is one of the methods used to remove $NH_3$ from the exhaust gas.