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*by* Muhammad Faizal

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# The Effect of Retention Time and Initial Concentration of Ammonia on Biological Treatment for Reducing Ammonia Content in Wastewater from Urea Fertilizer Industry

M. Faizal [1], Sri Haryati [1] Heni Kurniawati [2]

[1] Chemical Engineering Department, Faculty of Engineering, Sriwijaya University
[2] Chemical Engineering Study Program, Graduate School, Sriwijaya University

Corresponding author : faizal_ga58@yahoo.co.id

## ABSTRACT

As we know that, urea fertilizer Industry is one of important industries for supporting food consumption. But, in manufacturing process, this industry produces a wastewater containing ammonia. Before ammonia rejected to environment, it should be treated. Biological process at perforated plate with foam as attachment media and addition of ammonia degrading isolate is used as an alternative treatment with observing the effect of residence time and initial concentration of NH3-N on its pollutant degradation.
From this research, biological process occur with residence time of 63 to 250 minutes and range of initial concentration from NH3-N 276 to 530 mg/L. The results are as follows: removal of ammonia of 20.92 – 56.52%, COD of 48.46 – 74.52 %, and TKN of 17.69 – 44.89 %.

**Key Words:** Treatment, Wastewater, Urea Fertilizer Plant

## INTRODUCTION

The activities undertaken by the people such the activities of forestry, agriculture, plantations, trade and industry and others will lead to positive negative impact. Similarly, environmental quality will decline due to the activities of production and consumption in addition to the higher carrying capacity and environmental pacity are relatively more limited. The facts above requires us to act wisely in meeting all the needs that the implementation of the activities necessary to reduce the waste generated, and implement recycling.
In general, untreated wastewater contaminants contain multiple components that can have a negative impact on human life and the environment as the liquid waste generated from ea fertilizer industry. The parameter pollutants ntained in the wastewater in accordance with the Decree of the Governor of South Sumatra No. 13 Year 2002 are pH, TSS (total suspended solid), COD (Chemical Oxygen Demand), Ammonia, TKN (total Kjedal nitrogen), oil and grease. mmonia as one of the parameters of wastewater oduced is a compound colorless, pungent and ercing are in the water at certain concentrations n be toxic to fish and plankton and raise the pH the solution. At high concentrations of ammonia can use eutrophycation of water.
In order to maintain the water quality of the receiving stream as a body of liquid waste disposal particular the parameters of ammonia generated from urea fertilizer industry is necessary to treat it. creasing temperature of wastewater and stream flow rate and decrease of the reflux ratio improve the urea and ammonia removal efficiency (Rahimpour et al. 2010)
Therefore in this study biological wastewater eatment using a perforated plate column, filled by foam as a culture medium for bacteria and aeration processes that were previously carried out the process of neutralization and sedimentation by using settling tanks.
Several researchers have made use of microbes as degrading ammonia in wastewater, nitrifying organisms found almost in all aerobic

biological treatment, but usually their number is limited (Metcalf and Eddy, 1991). Sotirakou et. al. has conducted research in the biological removal of ammonia with extended aeration system (extended aeration). According to Robert A. Zimmerman et. al. (WEFTEC 2001) levels of ammonia removal can be carried out through a process of moving bed media and providing media with aeration ponds to provide the surface area necessary for nitrification same as the process trickling filter. Nitrification process can be interpreted as a formation of nitrate and nitrite nitrogen-containing materials are biologically reduced (Alexander 1971 in Elly

## METHODOLOGY

Experiments carried out by flowing liquid waste from storage tanks with pH maintained at 7-9 by adding $H_2SO_4$ concentration and then entered into the sedimentation tank at a flow rate of 50, 100 and 200 mL/min and then flowed into a perforated plate column with the addition of 15 ml isolates (2 , 2 x 1010 cells / ml) and air flow to the compressor to maintain a minimum DO concentration of 2 mg/L from the bottom of the column with a variation of the initial concentration of $NH_3$-N for each waste flow rate which is then channeled to the final sedimentation tank as in the picture series of tools by measuring the levels of dissolved oxygen (DO), pH, TSS, COD, TKN, $NH_3$-N in the influent and effluent for 16 and 20 hours after operation.

Yulita 2002). The importance of microorganisms in the biological process so that the research in biological wastewater treatment using a perforated plate column was carried out with the addition of ammonia to be degrading bacteria obtained from the liquid waste isolation Urea. This study was conducted with the aim of determination the influence of residence time and the initial concentration of ammonia in wastewater on reduction of ammonia, COD and TKN

The equipment schemes can be seen in Figure 1.

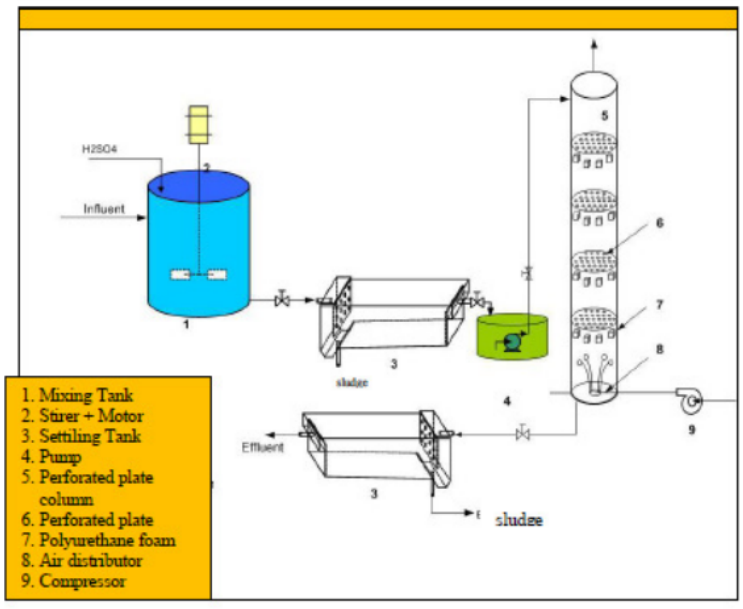


**Fig 1 Biological wastewater treatment using Perforated Plate Column**

## 2 RESULTS AND DISCUSSION

Analysis of some parameters under this experiment is intended to see how much influence the process of wastewater treatment plant biological urea aerobically degrading bacteria with the addition of ammonia (NH3-N). Based on the results of research conducted indicates that the variation of wastewater discharge associated with time stay as well as the initial concentration of NH3-N effect on the decline. The greater the initial concentration of NH3-N for the same time, the percentage of decrease will be smaller this can be seen in the following figures :

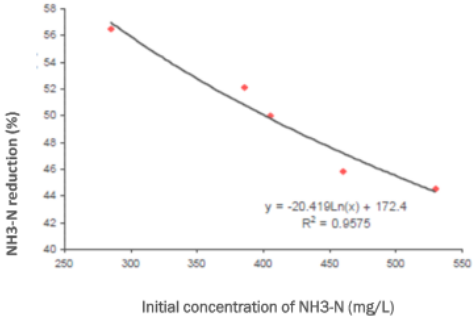


**Fig 2 : The effect of initial concentration of NH3-H on it reduction at flowrate : 50 mL/mnt, and retention time : 250 minutes**

At the beginning of NH3-N concentration of 285 mg/L concentration decreased by 56.52% and for the concentration of 530 mg/L decrease amounted to only 44.59%. This is due to the magnitude of the initial concentration of NH3-N load entering the greater thereby affecting the activity of NH3-N degrading bacteria that exist due to the addition of bacteria at the same time the magnitude of the disenfranchised. It can also be seen in the graph on each effluent discharge.

In the discharge of 100 mL/minute with a residence time of 125 minutes biggest percentage drop is only 41.74% for the initial concentration of 325 mg/L, the initial concentration of 516 mg/L decrease of only 30.5%.

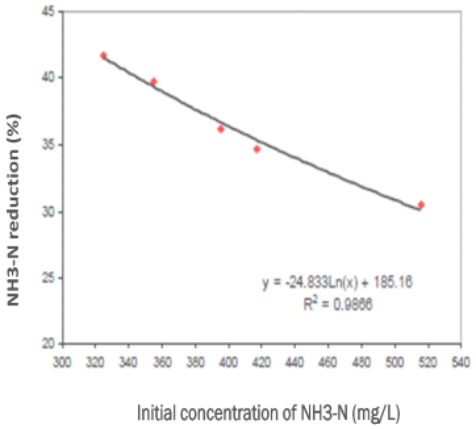


**Fig 3 : The effect of initial concentration of NH3-H on it reduction at flowrate : 100 mL/mnt, and retention time : 125 minutes**

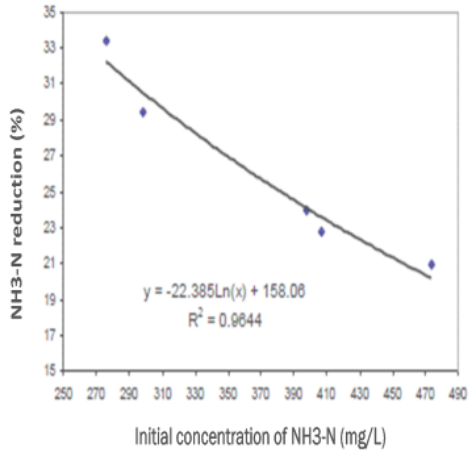


**Fig 4 : The effect of initial concentration of NH3-H on it reduction at flowrate : 200 mL/mnt, and retention time : 62.5 minutes**

In the discharge of 100 mL/minute with a residence time of 62.5 minutes biggest percentage drop is only 33.30 % for the initial concentration of 275,00 mg/L, the initial concentration of 474 mg/L decrease of only 21.1 %.

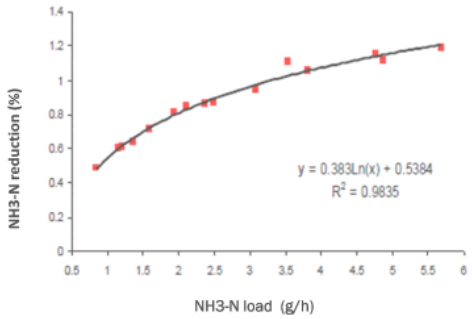


**Figure 5 : Effect of influent NH3-N load to NH3-N reduction.**

From the graph it appears that the effect of influent NH3-N load to decline with the observation that the observed range of load 0.855 g / h up to 5.688 g / h is the equation Y = 0.3813 ln (X) + 0.5391 where:
Y = Decrease in concentration (g/h)
X = Load influent (g/h)

**Table 1 : Correlation between wastewater flowrate and TKN reduction (%)**

| No. | Flowrate (ml/mnt) | Retention time (minute) | Initial consentration of TKN (mg/L) | Final consentration of TKN (mg/L) | TKN concentration reduction (%) |
|---|---|---|---|---|---|
| 1. | 50 | 250 | 489<br>538<br>640<br>712<br>953 | 269<br>308<br>376<br>439<br>612 | 44,89<br>42,68<br>41,25<br>38,34<br>35,73 |
| 2. | 100 | 125 | 479<br>518<br>541<br>655<br>853 | 309<br>340<br>359<br>464<br>620 | 35,49<br>34,36<br>33,64<br>29,19<br>27,32 |
| 3. | 200 | 63 | 455<br>462<br>545<br>634<br>742 | 348<br>358<br>433<br>512<br>611 | 23,51<br>22,51<br>20,46<br>14,2<br>17,69 |

Parameters of TKN (total Kjedal Nitrogen) which is a component consisting of nitrogen and organic nitrogen from NH3-N concentration decreased by 17.69 to 44.89%, the table can be seen for an operation time of 125 to 250-minute, it declined from 35.34 to 44.89%. It is indicated that the addition of the same amount of bacteria, residence time affected nitrogen decomposition process. The addition of bacteria accelerated the oxidation process of organic nitrogen compounds and NH3-N into simpler compounds.

**Table 2 : Correlation between wastewater flowrate and COD reduction (%)**

| No. | Flowrate (ml/mnt) | Retention time (minute) | Initial consentration of COD (mg/L) | Final consentration of COD (mg/L) | COD concentration reduction (%) |
|---|---|---|---|---|---|
| 1. | 50 | 250 | 257<br>71<br>116<br>98<br>241 | 71,5<br>18,08<br>32,74<br>26,22<br>65,74 | 72,18<br>74,54<br>71,77<br>73,24<br>72,72 |
| 2. | 100 | 125 | 139<br>167<br>97<br>225<br>243 | 46,82<br>54,73<br>32,47<br>79,87<br>80,45 | 66,31<br>67,23<br>69,05<br>64,5<br>65,62 |
| 3. | 200 | 63 | 181<br>89<br>83<br>194<br>167 | 86,85<br>42,3<br>39,34<br>99,97<br>84,58 | 52,02<br>52,47<br>52,6<br>48,46<br>49,35 |

For COD parameters with the addition of bacteria and wastewater discharge variations, that the residence time will give effect to the reduction in COD. COD values provide information about the oxygen required to oxidize organic and inorganic substances into carbon dioxide and water. So the higher the COD reduction will biodegrade contaminants. At a residence time of 63 to 250 minutes a decrease in concentrations of 48% to 74%. It indicated that at that time range, the decomposition of biological contaminants have been running well.

## CONCLUSSION

1. Percentage decrease in NH3-N obtained at the largest residence time of 250 minutes with a flow of 50 mL/mnt is 44.59 to 56.52% over a range of initial concentrations of NH3-N were observed 285-530 mg/L.
2. Percentage of NH3-N reduction is not only dependent on the residence time but also on the magnitude of the influent loading.
3. Wastewater treatment can also reduce value of :
   - COD from 48.46 to 74.52%
   - TKN 17.69 to 44.89%

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