UNIVERSITEIT GENT

FACULTY OF **BIOSCIENCE ENGINEERING**

Ammonia stripping and scrubbing pilot

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Introduction

Ammonia can be removed from digestate and captured in a marketable product, using the stripping and scrubbing technology:

1. **Stripper**: ammonia is removed (stripped) out of the liquid fraction of digestate by blowing air through the liquid stream in a tray stripper (WATTRAY®).
2. **Scrubber**: the stripping gas charged with ammonia is put into contact with a sulphuric acid solution in a packed scrubber (WATPACK®), resulting in ammonium sulphate, which can be used as an N-S-fertiliser.

This study investigated the optimal process parameters of a stripping and scrubbing pilot. In the first phase, batch tests were performed in which the optimal temperature for ammonia removal and ammonium sulphate recovery was examined.

Pilot lay-out

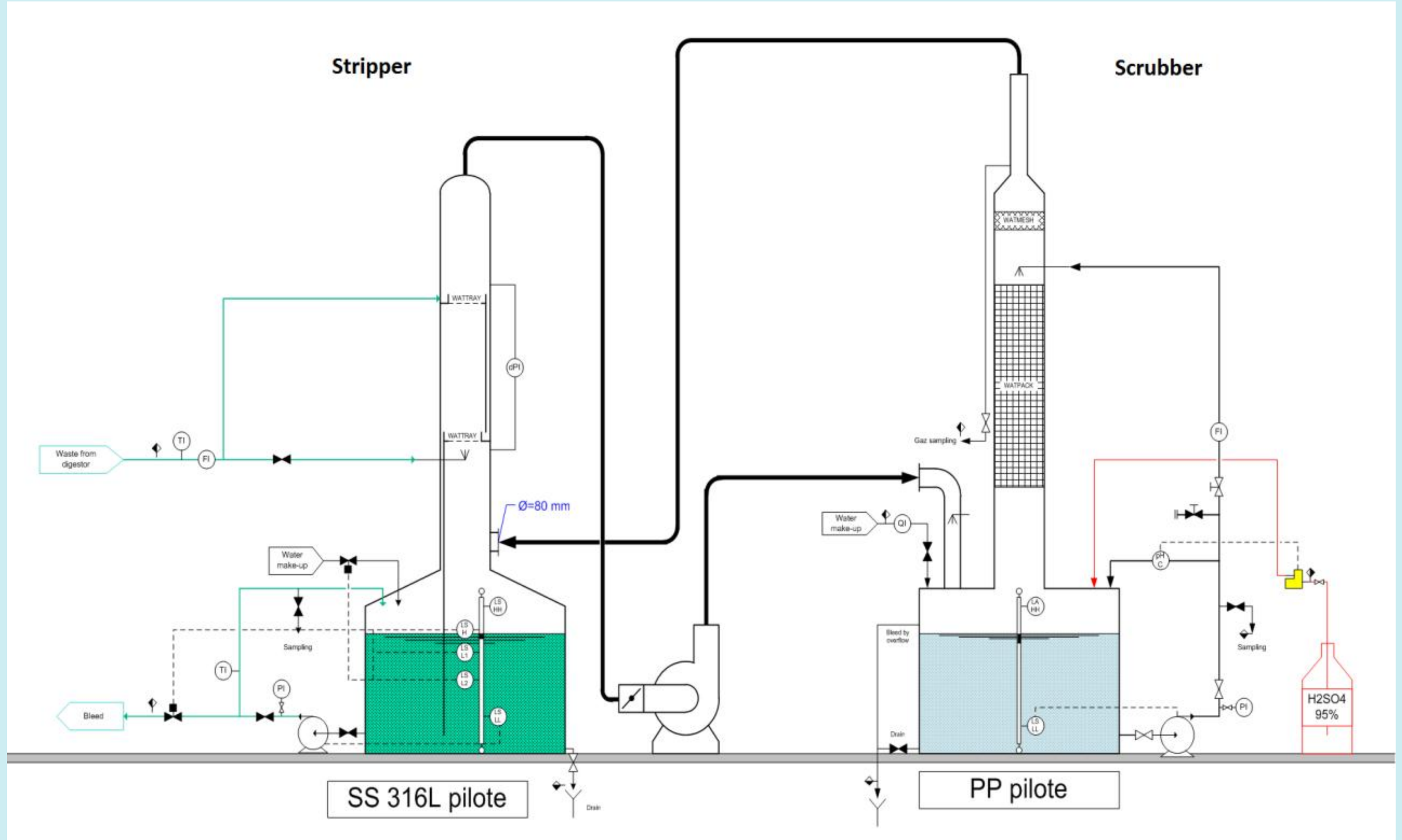

Figure 1. Diagram of the stripping and scrubbing pilot

Experimental set-up

It is expected that at higher stripper temperatures, more ammonia can evaporate and that consequently, the removal efficiency will be higher. To determine the optimal temperature, three types of tests were performed after the start-up of the pilot:

- Test 1: the temperature of the digestate liquid fraction was 50 – 60° C
- Test 2: no heating
- Test 3: application of maximum attainable temperature of the heat exchanger by increasing hot water flow

Figure 2. Ammonia stripping and scrubbing pilot at Waterleau, Ieper

Other parameters of the digestate and air stream in the stripping and scrubbing unit are shown in Table 1. Next to that, the flow of the fan connecting the two units was kept constant at 500 m³/h.

Table 1. Properties of the digestate and air stream in the stripping and scrubbing unit

	Stripper	Scrubber
Flow	1500 L/h	5.5 m³/h
Temperature	To be optimised	N/A
pH	8.1 - 8.5	3 - 5

Results

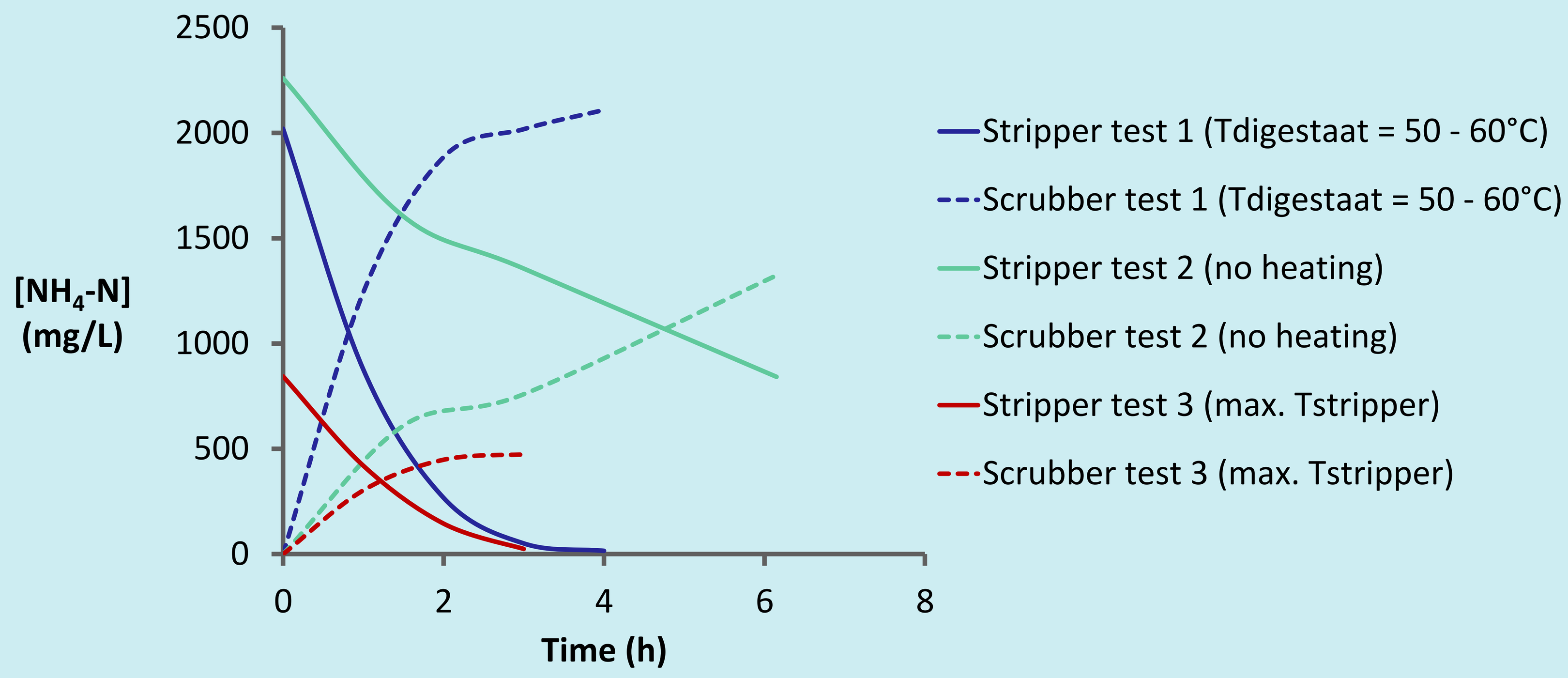

Figure 3. Influence of stripper temperature on ammonia removal

Remark: due to varying influent compositions, depending on the digested material, the initial ammonia concentrations varied among the different tests as well, ranging from 844 to 2260 mg/L.

From the graph (Figure 3) following conclusions can be derived:

- Test 1 resulted in optimal ammonia removal (in the stripper unit) and optimal ammonium sulphate recovery (in the scrubber unit).
- Test 2, not heating the stripper unit, resulted in low ammonia removal. Because of a blockage in the heat exchanger, the flow of the digestate stream was a lot lower.
- Test 3 showed, against expectations, a low ammonium recovery rate which can be explained by the fact that large quantities of condensate were formed and consequently a lot of ammonia was lost.

Conclusion

Heating the digestate stream up to 50 to 60° C should be sufficient to efficiently remove ammonia and recover ammonium sulphate in a reasonable time frame of 3 hours. In an optimally designed set-up higher temperatures will increase the removal efficiency, but in the current set-up more gas loaded with ammonia is lost at higher temperatures.

Current work and future perspectives

Currently, the pilot runs in semi-continuous mode in which every hour 66 L of digestate is drained from the stripper unit which is then filled back with fresh influent. Later on, the influence of increasing the pH value (9 – 10) of the digestate stream will also be investigated.

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