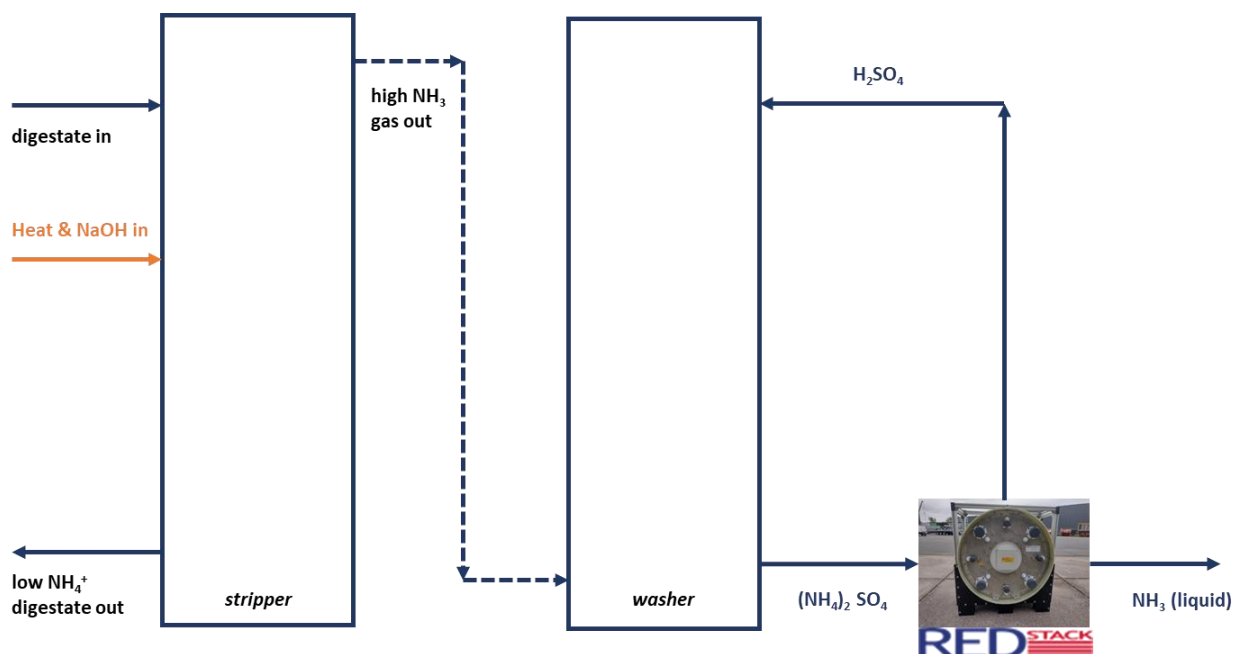


Chemical free operation of NH_4^+ -strippers

Introduction

In anaerobic digester processes, there is often a lot of NH_4^+ available. When the digestate is dewatered this NH_4^+ needs to be removed from the dewatered sludge. In some cases the NH_4^+ needs to be removed, because the concentrations are so high that they are toxic to the biology, for example with chicken manure digestion. For removal of NH_4^+ strippers are used, to strip the NH_4^+ out of the water, with addition of caustic and heat. The stripped NH_4^+ is then washed in a scrubber with H_2SO_4 , and normally trucked away as $(\text{NH}_4)_2\text{SO}_4$ fertilizer.

This use of H_2SO_4 can be prevented by placing an electro membrane stack with bipolar membranes in the $(\text{NH}_4)_2\text{SO}_4$ stream, and produce NH_3 and reuse the H_2SO_4 in the scrubber.



Nitrogen process

Inside the Electromembrane stack within the Bipolar membranes (EDBM) H_2O is split into H^+ and OH^- acid and caustic. By adding a cation exchange membrane in the stack, the NH_4 is changed to NH_4OH or NH_3 .

The NH_3 can be sold for various applications in the industry, such as flue gas denox, or fertilizer raw material.

The EDM stacks of REDstack have no carry over of liquids between compartments, so the H_2SO_4 can be reused many cycles, and the process can be operated without trucking chemicals to site.

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Results

Tests have performed on semi-technical scale at a stripper of a municipal waste water treatment plant in the Netherlands, see below picture.



The results are good at 100% N-removal at a total energy use < 7 kWh/kg N removed, the target number. The concentration of NH_3 that comes out of the process is 10%.

The H_2SO_4 reuse efficiency was $> 99\%$

EDBM Stack features:

- ▶ No carry over of liquids between compartments
- ▶ $> 99\%$ efficiency in reuse of H_2SO_4
- ▶ Modular design for easy upscaling
- ▶ Minimized gas accumulation due to vertical membrane pile arrangement
- ▶ Enhanced current distribution, due to patented cross-flow design, with optimal usage of ion exchange and bipolar membranes active area.