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Desulphurisation technology for gas-highly efficient, dynamic, compact

Removal of H_2S from biogas and other product gases containing methane and hydrogen - highly efficient, flexible and compact

Biogas and other process gases frequently contain highly toxic hydrogen sulphide (H_2S), which must be removed through washing and filter processes.

Objective

The aim of Prof. Michael Harasek and his research group "Thermal Process Engineering and Simulation" at TU Wien was a process for desulphurisation of biogas, which can reliably remove variable hydrogen sulphide contents – it is usual in biogas production – and is structurally more compact than established processes. Furthermore, the innovation should be able to be integrated well into existing systems and ensure automatic operation with low service costs.

Three-stage desulphurisation system for 500m³/h biogas with 99+% separation efficiency for H_2S

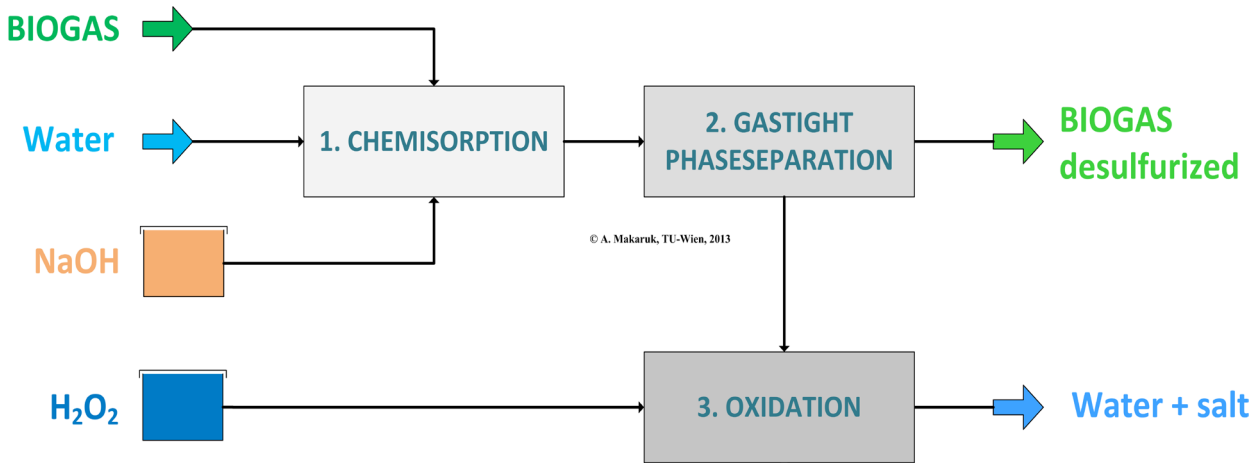
Approach

The approach is based on a chemical washing process, in which biogas is intensively exposed to a concentrated alkali hydroxide solution, for example sodium hydroxide, in a washing apparatus. The selectivity between the absorption of hydrogen sulphide and carbon dioxide is achieved by keeping the contact time as short as possible and preferably using the favourable absorption kinetics for the separation of the hydrogen sulphide.
The two-phase gas/washing agent mixture then immediately undergoes a phase separation, in which the gas is freed of fluid. The separated washing solution is subsequently subjected to oxidation with hydrogen peroxide in a separate reactor to that of the gas phase. The reaction yields a non-toxic, aqueous sodium sulphate solution and can, for example, be fed to the biogas fermenter or the discharge system.

Results

The process initially proved itself worthy for use on a laboratory scale at a gas volume flow of approximately 1 m³/h. In the next step, a mobile, flexible test stand which could be used for up to 200 m³/h of biogas was erected. The system comprises all features necessary for operation, such as control technology and a device for automatic chemical dosing. On this small, industrial scale, the process was optimised for a real biogas system and was positively evaluated on all objectives during several months of pilot operation.

The assessment of the system in the laboratory and in field trials has proven that this process can achieve a



Scheme of the new TU Wien process for biogas processing using an intensive chemical-oxidative scrubber

degree of separation of over 90% in a single separation step, whilst simultaneously reducing chemical consumption.

Expanding the process to include several purification steps enables a further reduction in chemical requirements and can achieve degrees of separation of over 95% and up to 99%. This retains the high level of compactness of the system, as well as the associated advantages, such as outstanding pressure stability, low construction costs and a simple approval procedure.

A new reference system for the industrial production of biogas (500m³/h) will be used for feeding into the natural gas network. It has a three-stage design with further reduced chemicals requirement and especially high degree of desulphurisation.

Benefits for you

This reliable process for removing H_2S from bio gasses and other product gases containing methane and hydrogen offers the following advantages:

- simple integration into existing systems
- low construction volume
- high process reliability with fluctuating sulphur contents
- stable operating pressure
- high degree of automation
- use of simple and common chemicals
- significant noise reduction (virtually silent)
- simple approval procedure
- inexpensive scale-up
- low investment and operating costs

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