Full-scale Experience with THIOPAQ® Technology from Paques - An Elegant Way to Desulphurise Biogas

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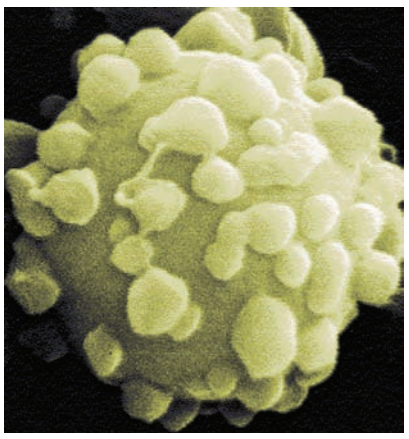
European governments have increasingly recognised the fact that fossil fuels on earth are limited and that alternative energy sources need to be developed and implemented. Wind, sun and biomass are widely recognised as new sources of renewable energy. Most countries have set ambitious targets for the development of alternative energy sources. Germany with its Feed-In Tariff Program is one of the front runners for stimulating sustainable energy development and use. This programme is largely followed by Canada and USA and in addition to stimulating the production of bioethanol, the programme also promotes the usage of biogas and landfill gas for combined heat and power generation (CHP). Upgrading biogas to biomethane subsequently produces a vehicle fuel that is promoted in Sweden and this development is followed by South Korea.



Biogas is produced through the anaerobic digestion of wastewaters. The biogas produced by methanogenic communities contains methane ranging from 50 to 80v%, with the remainder being CO_2 and H_2O. Anaerobic lagoons and landfills are the most simple and straightforward environments for biogas production, whereas digesters, UASB and IC reactors are the more advanced bioreactors. The produced biogas is collected and can be used as a source of sustainable green energy.
If sulphate, organic sulphur components and proteins are present, sulphate-reducing bacteria will compete with the methanogens for COD-usage.

In general the sulphate amount is much less than the COD content, almost all sulphate is reduced by the sulphate-reducing organisms to sulphide. The sulphide will appear in the biogas and its concentration can range from several ppm up to 3v%. Prior to use, the biogas for CHP requires H_2S to be removed to prevent the production of acid rain and possibly more importantly to prevent corrosion and protect the oil in the engine from acidification. An efficient way to desulphurise biogas is the THIOPAQ® technology from water technology company Paques from the Netherlands.

Working Principle of the THIOPAQ® Technology

TThe principle of the THIOPAQ® technology relies on the physical-chemical absorption of H_2S into a mild caustic solution (pH between 8 and 9) and the almost complete regeneration of the caustic by bacteria in a separate bioreactor, whereby elemental sulphur is produced. The elemental sulphur is in principle an excellent fertilizer or fungicide. Long-term performance data of full-scale plants show that over a long period (10 years and 3 years) the H_2S from the biogas is removed to very low values (< 75 ppm for 95% of the period). The largely fluctuating biogas flow does not influence this removal efficiency. This is explained by the usage of the mild alkaline solution, whereby the specific caustic consumption is 0,3-0,6 kg NaOH/kg S, which is at least five times lower than a conventional caustic scrubber. The very high reliability results in 99% availability for producing heat and power from the desulphurized biogas.

Development of the THIOPAQ® Technology

The successful pilot-plant testing was performed in 1991 in The Netherlands. At the same location the first full-scale THIOPAQ® was built in 1993 and is still in operation. The number of references grew steadily with a total of over 120 in 2010.

The development of the technology is nicely shown in Figure 1 below. From the first full-scale (Figure 1a), the modular THIOPAQ® was developed (Figure 1b). This type consists of a smaller footprint and comprises of an absorber, bioreactor and settler combined with housing for control and rotating equipment. The latest development involved an even smaller footprint in which the different components are merged into a skid mounted plug-and play piece of equipment (Figure 1c).

The THIOPAQ® installations range from very small standardised units to very large custom made design. The (bio)gas flows range from 10Nm³/hr to more than 50,000 Nm³/hr. The daily sulphur loads range from 10 kg to 50 tonnes.

THIOPAQ® is recognized by:

- High uptime > 98%
- High reliability
- Low maintenance time
- Deep H_2S removal < 25 ppm guaranteed

Figure 1a: First full-scale THIOPAQ®

Figure 1b: Modular type THIOPAQ®

Figure 1c: Compact THIOPAQ®