Amonia gas absorption technology (AGATE)

Reporting

Project Information

AGATE

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Project closed

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Coordinated by
CIRMAC INTERNATIONAL BV
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Final Report Summary - AGATE (Amonia gas absorption technology)

The AGATE project aimed to close the ammonia cycle in the industry and agricultural sectors through the development of advanced compact gas absorption technologies. More specifically, the project objectives were to:
1. improve and modify hollow-fibre membranes for 20 % faster ammonia transfer from gas phase to absorption liquid;
2. create uniform pore diameter distribution throughout the hollow-fibre membrane, with less than 10 %

deviation;
3. develop a mass transfer model for ammonia membrane gas absorption (MGA) through a membrane interface, with a predictive accuracy ranging from 90 % to 110 %;
4. develop an innovative sustainable technology for ammonia recovery from off-gas with more than 99 % efficiency, that would also be reliable and safe, and demonstrate lower operational costs than conventional technologies;
5. convert the ammonia from the off-gasses into a product that could either be directly reused in a production process, or be sold on the market as a product with standard quality specifications;
6. develop, integrate, scale up and test the different process components to obtain an integrated, flexible and efficient solution that would be certified during six months of end-user tests.

The project was structured in five distinct, yet interrelated, work packages (WPs), which undertook various activities. Firstly, the emissions at the sites where the MGA unit was planned to be tested, were quantified to determine the criteria for the off-gas properties that would be purified by the unit. Similarly, criteria for the reuse of the ammonia salt that was produced during the process were developed. The performance of the unit's membranes was analysed, evaluated and improved and the optimal alternatives were selected. Moreover, the membrane absorber was designed and its potting material was tested.

The basic concept of the MGA unit was thus established and the designed membranes were prefabricated in order to be subjected to long-term testing. The issues of controlling the off-line installation performance, in order to ensure online data transfer, analysis and publication at an affordable cost and develop an engineering plan for the installation process were discussed during the detailed design phase.

The unit was subsequently constructed at a prototype scale and functionality tests were performed, to identify necessary device improvements. Ammonia removal was highly efficient at various gas flow rates; however the obtained results remained below the anticipated theoretical values. Therefore, modification of the auxiliary modules and equipment was necessary. In addition, the analysis of the produced ammonia sulphate demonstrated that the amount of metal ions was below the application limits for fertilisers, thus implying the necessity for further optimisation. The undertaken data analysis included the development of a mass transfer model, which served as a tool for the comparison between the actual and predicted MGA unit performance.

The project resulted in the production of very flexible, highly efficient membranes for ammonia removal. The total cost of the proposal was below the average cost of conventional absorbers and could be further reduced in the future; therefore the solution was commercially competitive. A total cost reduction of 60 %, in comparison to existing solutions, appeared to be feasible in the near future. A European marketing campaign was planned as part of AGATE, even though it would start well beyond the project completion, following the successful operation of the MGA plant for more than 12 months.

Related documents

Final Report - AGATE (Amonia gas absorption technology)

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