Danish researchers develop budget optical ammonia sensor

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In collaboration with the Technical University of Denmark (DTU), the Department of Engineering at Aarhus University has developed photonic sensor technology that can pave the way for a portable, reliable and, above all, inexpensive device for detecting ammonia and other gases in agriculture.

Working with chemists and chemical engineers, photonics researchers

from Aarhus University and DTU have developed a new sensor system that could contribute to a significant reduction in air pollution in Denmark.

The researchers have developed an integrated optical sensor, based on modern telecommunication technology, that measures ammonia in the air using a laser, a gas sensor and hollow-core optical fibers.

The new sensor has been described in the scientific journal *MDPI Photonics*.

"Our device demonstrates that it is possible to carry out continuous ammonia monitoring for the agricultural sector, and because it is based on mature telecommunications technology, the system can be built at very low cost. At the same time, the system is very compact, and it meets the need for a portable, reliable and above all inexpensive system for detecting ammonia," says Andreas Hänsel, a postdoc from Aarhus University and part of the Photonic Integrated Circuits research group.

Development of the sensor technology is still ongoing, and focus is currently on increasing the sensitivity of the equipment. Andreas Hänsel also says that, although the new sensor has been developed to detect ammonia, it can easily be configured to detect a wide range of other gases, including greenhouse gases.

The new technology has been developed as part of the Ecometa project, which has received DKK 12.5 million funding from Innovation Fund Denmark.

In collaboration with leading Danish technology companies, the project researchers have been looking for new methods and developed technology to measure and reduce air pollution from the agricultural sector for several years.

Livestock production is today responsible for a significant part of Danish air pollution, primarily from ammonia, which is one of the largest environmental problems for agriculture. However, emissions of ammonia are not measured at all today at farm level, as such measurements are rather expensive.

"Ecometa is a very relevant research project with great prospects for agriculture. The ability to continuously and cost-effectively track the development in ammonia emissions from agriculture provides completely new opportunities for the industry to experiment on reducing the emissions," says Kent Myllerup, Head of Pig Innovation at SEGES and chairman of the steering committee for Ecometa.

Today, air pollution from agriculture is based on standard figures, but a future prospect of continuous farm level measurements could be an incentive in the green transformation of the industry, explains Associate Professor Anders Feilberg, who heads Aarhus University's part of the project:

"The new technology takes us one step closer to enabling farmers to monitor their emissions continuously. With accurate monitoring of ammonia emissions from sheds and stables, farmers can streamline operations far better. This takes us closer to emissions-based regulation using measured emissions, and it can significantly reduce the environmental impact of agriculture," says Associate Professor Anders Feilberg, who is heading Aarhus University's part of the Ecometa project.

The project will run until 2021, and it will help comply with Denmark's international commitments for the environment, especially with regard to ammonia.

More information: Andreas Hänsel et al, Integrated Ammonia Sensor

Using a Telecom Photonic Integrated Circuit and a Hollow Core Fiber, *Photonics* (2020). DOI: 10.3390/photonics7040093