

Scientists design graphene filter to purify methane from biogas

October 10 2019, by Lucy Carroll



UNSW scientists have demonstrated that graphene membranes can be used to purify methane that is present in biogas generated during the breakdown of materials in wastewater plants. Credit: University of New South Wales

UNSW researchers are using 'wonder material' graphene to generate sustainable energy in municipal wastewater treatment plants.

UNSW scientists that developed a [graphene](#) filter to improve the quality of drinking [water](#) have discovered a new application for the very thin form of carbon – the ability for graphene to purify methane from biogas produced in [wastewater plants](#).

The research team, led by Dr Rakesh Joshi of the UNSW School of Materials Science and Engineering, has demonstrated at lab-scale that graphene membranes can be used to extract methane present in biogas generated during the breakdown of organic materials in wastewater plants.

The research indicates that it is possible to purify methane from biogas in a wastewater treatment plant environment, creating a potential source of renewable energy. Biogas, a mixture of methane and other impurities, is produced during anaerobic digestion in wastewater treatment – the process of bacteria separating biodegradable material.

"We are working in close collaboration with Sydney Water to convert these findings into a retrofittable technology for [wastewater treatment plants](#)," Dr Joshi said. "Graphene, a thin sheet of carbon atoms that forms in a honeycomb pattern, is considered a wonder material which is stronger than steel. Our team focuses graphene research to generate innovative solutions that industry can use."

UNSW's Graphene Team, in partnership with Sydney Water, has already successfully demonstrated a graphene-based, laboratory-scale filter that can remove more than 99% of the ubiquitous natural organic matter left behind during conventional treatment of drinking water.

"Our group's latest research indicates that it is possible to use graphene to extract and refine methane to be recycled and reused as a source of energy," Dr Joshi said.

Dr Heri Bustamante, Principal Scientist in Treatment at Sydney Water, said there was a need to develop more cost effective and easier to operate technologies to purify the valuable methane in biogas.

"Sydney Water currently uses biogas produced in the [wastewater treatment](#) process to generate energy. The use of graphene will enable increased capture of methane to expand potential uses beyond the requirements of Sydney Water. Production of methane to fuel buses could be a potential future use, for example," said Dr Bustamante. "This would contribute to the potential of creating a circular economy at Sydney Water."

Dr Joshi said: "This is positive news for the wastewater and the renewable energy industries as it will be possible to use the purified [methane](#) for other applications. The graphene-based membranes show the removal of carbon dioxide from the mixture of gases."

In 2018, [the team conducted tests on samples](#) from Sydney Water's Nepean Water Filtration Plant in Western Sydney with results removing almost 100% of natural organic matter while maintaining high water flow at atmospheric pressure. Each day, Sydney Water supplies 1.5 billion litres of drinking water which is treated at one of nine water filtration plants, or the desalination plant.

Dr Joshi's team have been working with Sydney Water for the past four years to develop a graphene membrane design that is now being scaled up for commercialisation. It is expected the graphene membranes will be ready for plant trials at Sydney Water within the next five years.

Provided by University of New South Wales

Citation: Scientists design graphene filter to purify methane from biogas (2019, October 10)

retrieved 20 March 2024 from <https://phys.org/news/2019-10-scientists-graphene-filter-purify-methane.html>

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