New methane bioreactor produces environmentally friendly energy and mitigates climate change

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A new methane bioreactor, developed in the Natural Resources Institute Finland (Luke) boosts environmentally friendly energy to the markets. The reactor stores renewable energy and produces synthetic biomethane with good efficiency. The new technology can help in achieving a carbon-neutral society.

Scientists Anni Alitalo and Marko Niskanen at the Natural Resources Institute Finland (Luke) have succeeded in developing a methane bioreactor which produces energy as well as store solar and wind energy and water power. Moreover, the reactor can convert wood gas (synthesis gas) into very pure methane, which, after pressurization, is readily available for transportation fuel.

In the future, the technology can also be used to recycle industrial carbon dioxide emissions to methane production.

"This simple reactor with affordable running expenses will turn carbon neutral fuel cycle into reality. It is also in line with the European Union efforts to reduce the dependency on imported energy," says scientist Anni Alitalo.

Patent pending for two innovations

The developmental work has produced several innovations, of which

Luke has filed two patent applications. Professor Erkki Aura, the father of the invention, created the first version of the bioreactor enriching the appropriate microbial population from Finnish mire. This methane bioreactor produced methane and water out of carbon dioxide and hydrogen.

Alitalo and Niskanen further developed the technology; they improved the functioning of the reactor and tested different source gases.

According to the scientists, biological methane production is best suited to decentralized energy production systems, small-scale plants. The efficiency of the process is good. In the process, the loss of heat of combustion of hydrogen has been 20 percent tops.

The scientists found out that instead of pure source gases, hydrogen and carbon dioxide, also wood gas (synthesis gas) containing carbon monoxide can be used. They noticed that the microbes known as methanogens can produce carbon dioxide out of wood gas and further convert it into methane.

"We managed to convert all the components of wood gas that contain energy into methane, and methane can be used in more versatile ways than wood gas," Alitalo recalls.

Suitable for farms and industry

The scientists are now looking for partners to commercialize the innovation. Alitalo estimates that the first reactors will be in the market after two to three years. The aim is, firstly, to conquer the domestic market in farm and municipal size energy plants, secondly, to proceed to the industrial scale and global export.

"In the biogas plants on farms, for example, our reactor should be used

to produce methane out of carbon dioxide that biogas contains instead of releasing the gas in the atmosphere," the scientists recommend.

The methane bioreactor is cost efficient and suitable for energy production in Finland and abroad.

"In Germany, the reactor could store the excess of wind and solar energy, in Finland it could be used to improve the efficiency of wood and biomass energy. Our technology truly tackles climate change," scientists say.

Provided by Natural Resources Institute Finland