Engineering researcher finds new way to fight antibiotic-resistant bacteria

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New findings by civil engineering researchers in the University of Minnesota's College of Science and Engineering shows that treating municipal wastewater solids at higher temperatures may be an effective tool in the fight against antibiotic-resistant bacteria.

Heating the solid waste to 130 degrees Fahrenheit (55 degrees Celsius) was particularly effective in eliminating the genes that confer antibiotic resistance. These genes are used by bacteria to become resistant to multiple antibiotics, which are then known as "superbacteria" or "superbugs."

The research paper was recently published in *Environmental Science & Technology*, a journal of the American Chemical Society and highlighted in the society's weekly magazine *Chemical & Engineering News*.

Antibiotics are used to treat numerous bacterial infections, but the ever-increasing presence of antibiotic-resistant bacteria has raised substantial concern about the future effectiveness of antibiotics.

"The current scientific paradigm is that antibiotic resistance is primarily caused by antibiotic use, which has led to initiatives to restrict antibiotic prescriptions and curtail antibiotic use in agriculture," said civil engineering associate professor Timothy LaPara, an expert in both wastewater treatment and microbiology who led the new University of Minnesota study. "Our research is one of the first studies that considers a different approach to thwarting the spread of antibiotic resistance by

looking at the treatment of municipal wastewater solids."

Antibiotic resistant bacteria develop in the gastrointestinal tracts of people taking antibiotics. These bacteria are then shed during defecation, which is collected by the existing sewer infrastructure and passed through a municipal wastewater treatment facility. The majority of wastewater treatment plants incubate the solid waste, called sludge, in a "digester" that decomposes organic materials. Digesters are often operated at 95 to 98 degrees Fahrenheit (35 to 37 degrees Celsius).

"Many digesters are operated at our body temperature, which is perfect for resistant bacteria to survive and maybe even grow," LaPara said.

Lab research by LaPara and his graduate student David Diehl shows that anaerobic digestion of municipal wastewater solids at high temperatures (as high as 130 degrees Fahrenheit or 55 degrees Celsius) is capable of destroying up to 99.9 percent of various genes that confer resistance in bacteria. In contrast, conventional anaerobic digestion (operated at 95 to 98 degrees Fahrenheit or about 37 degrees Celsius) demonstrated only a slight ability to eliminate the same set of genes.

"Our latest research suggests that high temperature anaerobic digestion offers a novel approach to slow the proliferation of antibiotic resistance ." LaPara said. "This new method could be used in combination with other actions, like limiting the use of antibiotics, to extend the lifespan of these precious drugs."

LaPara also pointed out that raising the temperature of anaerobic digestion at wastewater treatment plants is not cost-prohibitive because the digesting bacteria produce methane gas that can be used to heat the reactor.

More information: To view the most recent research report published

in *Environmental Science & Technology*, visit z.umn.edu/lapara

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