How to tell when a sewage pipe needs repair—before it bursts

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The nation's sewer system is a topic most people would prefer to avoid, but its aging infrastructure is wearing out, and broken pipes leaking raw sewage into streets and living rooms are forcing the issue. To better predict which pipes need to be fixed, scientists report in the ACS journal *Environmental Science & Technology* that certain conditions in the pipes can clue utilities in to which ones need repair—before it's too late.

Mark T. Hernandez and colleagues note that the maintenance of U.S. wastewater collection systems costs an estimated $4.5 billion every year, much of which goes toward fixing or replacing 8,000 miles of sewers. In the future, these annual costs could top $12 billion. Part of the problem is corrosion caused by sewer gases that feed acid-generating microbes, which grown in biofilms on the inside top surface of the pipes. Although microbe communities have long been recognized as a factor in the corrosion of concrete pipes, they have not been well studied. To fill in the gaps, Hernandez's team decided to figure out what kinds of bacteria and other conditions were most closely associated with corrosion problems.

From 10 different sewer systems in major cities around the country, the scientists measured bacterial diversity, gas concentrations in the air above the wastewater and other factors. In the most worn pipes, they found markedly little variety in the kinds of bacteria present, as well as elevated levels of both hydrogen sulfide and carbon dioxide gases. The researchers concluded that wastewater utilities could economically monitor combinations of these gases in sewage pipes to figure out which sites might be at higher risk for corrosion and take the necessary steps to prevent major damage.

More information: "Carbon Dioxide and Hydrogen Sulfide Associations with Regional Bacterial Diversity Patterns in Microbially Induced Concrete Corrosion" *Environ. Sci. Technol.*, Just Accepted Manuscript, DOI: 10.1021/es500763e

Abstract

The microbial communities associated with deteriorating concrete corrosion fronts were characterized in 36 samples taken from wastewater collection and treatment systems in ten utilities. Bacterial communities were described using Illumina MiSeq sequencing of the V1V2 region of small subunit ribosomal RNA (SSU-rRNA) gene recovered from fresh corrosion products. Headspace gas concentrations (hydrogen sulfide, carbon dioxide, and methane), pore water pH, moisture content, and select mineralogy were tested for correlation to community outcomes and corrosion extent using pairwise linear regressions and canonical correspondence analysis. Corroding concrete was most commonly characterized by moisture contents greater than 10%, pore water pH below one, and limited richness (100 ppm) and carbon dioxide (>1%) gasses, conditions which also were associated with low diversity biofilms dominated by members of the acidophilic sulfur-oxidizer genus Acidithiobacillus.

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