Popular abstract

Human activities are each year responsible for the emission of large quantities of the compound ammonia. When ammonia is emitted to the environment it can result in damage to both plants and aquatic ecosystems. Furthermore, emitted ammonia can also pose a hazard for human health. In the atmosphere, ammonia can lead to the formation of small particles known as $PM_{2.5}$. These particles have been found to be a large part of the smog that can be observed in large cities around the world. Additionally, when the particles are inhaled they can cause damage in the lungs.

The majority of ammonia emission from human activities originate from agriculture. The emission can either come from the keeping of livestock animals or certain industrially produced fertilizers. All animals produce ammonia, but because it is toxic in too high amounts, animals have to find a way to get rid of it. Mammals convert ammonia into the compound urea, which can be safely stored and excreted in the urine. Livestock urine is thus a rich source of urea. By itself urea will remain as urea for a long time. However, an enzyme known as urease is able to catalyse the transformation of urea into ammonia. The enzyme is produced by many organisms, among others bacteria that inhabit the livestock feces. When the feces and urine from livestock animals are mixed, these urease producing bacteria cause the urea in the urine to be converted into ammonia. Because ammonia is volatile, it can easily be emitted through the air.

This PhD project has looked into what bacteria in pig feces are responsible for producing urease. The aim being, that by better understanding the cause of ammonia production, it will be easier to control ammonia formation and thereby reduce the emission. The project found that especially the bacterium *Streptococcus alactolyticus* seems to be responsible for urease activity in pig feces. Looking at its genes it was observed that this specie differs from all other known urease producing bacteria. The specie has the potential of producing extra high amounts of the enzyme urease. Furthermore, it was observed that *S. alactolyticus* increases urease production under acidic conditions.

Next, the project looked into ways to reduce urease activity, and thereby prevent transformation of urea into ammonia. A total of 72 different compounds were investigated, using a method developed during the project, to see if they reduced the enzyme's activity. It was discovered that combining the two compounds sodium fluoride and tannic acid, efficiently reduced urease activity both in the developed method and in a mixture of pig urine and pig feces. The effect was found to be synergistic, meaning that when combining the two compounds the effect was greater than what would be expected from the two compound's individual effect.