

## Chemical pretreatment of leftovers from agricultural residues to help microorganisms produce more biogas

When agricultural residues are used for biogas production, some non-degraded leftovers always remain. The leftover fraction remains because it is too complex for the biogas-producing microorganisms to degrade. Fortunately, there are ways to help these microbes out! By using a certain chemical pretreatment, where high temperature, high pressure of oxygen and a strong base are used, some degradation products arise from the leftover fraction. These degradation products can be more easily used by the microbes, making it possible to produce even more biogas. Not such a bad deal to simultaneously enable the use of residual material and enhance the production of energy, right?

The most favorable conditions for this chemical pretreatment were examined in this study, where a leftover fraction of wheat straw was used. Wheat straw is an agricultural residue that is produced in enormous amounts every year. The highest output of degradation products was achieved when the lowest amounts of the leftover fraction was used in the pretreatment. Some degradation products that were formed included vanillin, a well-known flavouring agent, acetic acid and formic acid. Which degradation products that were formed was, however, dependent on the pH stability during the treatment.

Studies like this are very relevant for the transition towards an energy production based on renewable resources, which is crucial due to climate change and depletion of fossil resources. One important part of the future energy production is biomass, as it is both renewable and seen as the fourth largest energy source in the world, after oil, coal and natural gas. Agricultural residues are an example of lignocellulosic biomass, which is of particular interest since it is inedible for humans and, therefore, does not compete with food production for arable land. A very efficient way to transform biomass to a useful type of energy is through biogas production, as it is naturally produced in multiple steps by microorganisms. Biogas is a mixture of methane and carbon dioxide, but where methane is the desired compound since it can be used as a fuel in vehicles or used for generation of electricity or heat.

One issue with producing biogas from lignocellulosic biomass, such as agricultural residues, is the high content of lignin. The lignin is, in other words, the leftover fraction that remains after biogas production from lignocellulosic materials. Lignin has a very complex structure, consisting of aromatic units connected in chains, which is why it is so hard for the biogas-producing microorganisms to degrade. With the studied chemical pretreatment, a well-known process called alkaline wet oxidation, the connections between the aromatic units in lignin are broken down and degradation products, such as aromatic compounds or organic acids, arise.

The findings of the study are a first step to optimize the use of the leftover fraction in agricultural residues. If the investigated chemical pretreatment is further developed, so more parts of agricultural residues can be made available for biogas production, the easier could a transition to renewable energy production become. So, let's continue to investigate how to help the biogas-producing microorganisms and, by doing so, develop a pretreatment that can contribute to a sustainable energy production!