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MATERIAL UTILIZATION OF AGRICULTURAL RESIDUES FROM HEMP CULTIVATION AND PRODUCTION - HEMP AS A CARBON SINK

Барт Сара / Sarah Barth (University of Applied Sciences Zittau/Goerlitz / ITMO University)
Научный руководитель – к.т.н., доцент Сергиенко О.И./ Scientific supervisor – PhD, associate professor Olga I. Sergienko (ITMO University)

To achieve their climate goals, the European Union must create so-called carbon sinks in addition to reducing emissions. Industrial hemp has a high potential as a carbon sink, as it absorbs more carbon than other crops. Currently, three options are available to quickly create carbon sinks using hemp. A holistic use of the plant can help humanity stop climate change.

Climate change is the central threat to life on earth as we know it today. The importance of climate protection has arrived in the awareness of the European population, which ultimately led to the issue becoming an important point in the in the policy of the European Union. At the end of 2018, the EU proclaimed the political goal of achieving climate neutrality by 2050, and in 2019, both the European Parliament and the European Council endorsed this goal. At the beginning of 2020, it was announced that this political goal would also be enshrined in law, and corresponding regulations have already been submitted.

Achieving climate neutrality requires two fundamentally different strands of action:
On the one hand, emissions reduction and, on the other, the creation of carbon sinks.

Studies and model calculations show that for industrialized economies an extensive reduction of energy-based greenhouse gas emissions is possible in the next 20-30 years. From a technical and systemic perspective, it is possible for Germany to reduce energy-based emissions by 95% compared to 1990 levels by 2050.

In addition to energy-based emissions, process emissions and emissions from agriculture must also be considered. However, emission reduction measures are not sufficient to achieve so-called climate neutrality. It can be assumed that in 2050 a sink volume in the order of 15% of 1990 emissions is required to reach the target. For the European Union, this 15% corresponds to a volume of around 850 million tons of CO2 equivalents.

There are several approaches to creating carbon sinks, which are also referred as negative emission technologies. However, the decisive factor for climate effectiveness is not only the active removal of carbon from the atmosphere, but also its safe storage over as long a period as possible.

Critical to climate relevance is that a solution can achieve a scalable and realistic sink volume. The sink potential for the solutions: Afforestation, Plant Charcoal, and Building Soil Organic Matter is estimated in current literature to be mostly 1-5 Gt CO2 per year for the year 2050. It has been scientifically proven that industrial hemp absorbs more CO_2eq per hectare than most commercial crops, making the plant a very potent carbon sink. It is estimated that hemp absorbs 1630 kgCO_2eg/t of hemp straw.

The long-term material uses of hemp components such as the fibers and shives in technical textiles or in composite materials can also bind the stored CO2 in the long term. It is important that the material use is measured in such a way that the humus content of the soil persists and increases rather than decreases.

By carbonizing biomass via pyrolysis, a large proportion of the carbon it contains can be converted into extremely stable forms. Plant charcoal is produced, as well as a pyrolysis oil and energy-rich process gas, depending on the process control. The potential uses of plant charcoal range from agriculture to building materials and many other applications.

When the biomass is pyrolyzed, about half of the carbon compounds in the biomass are converted into plant charcoal. This material is very durable and hardly decomposes biologically or chemically. Provided that plant charcoal is not burned but remains in material applications, a carbon sink is created, always assuming that existing terrestrial carbon stocks are not diminished by providing the biomass.

Plant charcoal can be produced from hemp dust and short fibers, for example, which are produced as a waste product during the processing of hemp straw .
By using alternative management practices such as green manures, under sowing, conservation tillage, or mixed cropping, the organic carbon content of soils can be increased. In its report on the soil condition survey of Germany, the Thünen Institute assumes that the humus content in arable soils is decreasing under the currently practiced management methods.

Since the roots and mulch remain on the field during hemp harvesting, these substances enter the soil as green manure.

As a result, it can be said that the three solutions individually already have high potentials to create carbon sinks. The combination of the solutions, however, creates a more efficient way to quickly reach the goal and consequently to fight climate change.

Сара Барт/ Sarah Barth (author)

О.И. Сергиенко/ Olga I. Sergienko (scientific supervisor)