Azienda Agricola Leona: an example of technological innovation for the production of biomethane from cereal straw

Crop residues, and in particular cereal straw and corn stalks, are a type of biomass widely available and scarcely used for energy purposes. In fact, being mainly made up of cellulose and hemicelluloses, closely linked to a non-negligible amount of lignin, they are degraded with great difficulty - and very long times - by the microorganisms responsible for the anaerobic digestion process and are therefore generally used only in limited quantities, and mixed with other biomass, to feed biogas plants. In order to effectively use straw as a raw material for the production of biogas and biomethane, it is necessary to use innovative pre-treatment technologies that make cellulose and hemicelluloses more accessible to microbial attack and allow them to convert into methane quickly and with high yields the sugars that compose these polysaccharides. An example, unique of its kind in Italy, of technological innovation aimed at using straw as a raw material for the production of biogas and biomethane is represented by the Leona farm in Codigoro (FE), which started up in November 2020 a plant with a maximum production capacity of 600 Sm3 of biomethane (98% of CH4) to be introduced into the national natural gas distribution network. The production process makes use of various innovative technologies, starting from a pre-treatment known as "steam explosion" which consists in saturating the straw in a special reactor with steam at high temperature (170 °C) and pressure (8 bar) and then causing a very rapid decompression, thus leading to the "detachment" of the cellulose and hemicelluloses from the lignin and to a degradation of the crystalline structure of the cellulose which facilitate the subsequent action of the microorganisms. The pre-treated straw is then sent to anaerobic digestion, carried out in thermophilic conditions (about 60 °C) and in reactors without moving mechanical parts.

KEY WORDS

Biomethane, bioenergy, rural areas, biomass, ce-real straw, steam explo-sion, technological inno-vations, circular bioe-conomy

COUNTRY/REGION

Italy/Emilia Romagna

AUTHORS

Vito Pignatelli,
ITABIA

ADDITIONAL INFORMATION

The agitation of the fermenting biomass is ensured by a system of pumps which avoids, with continuous mixing, the formation of "crusts" and minimizes the need for maintenance. The technology used for upgrading biogas to biomethane is also highly innovative, as it is based on the chemical absorption of CO2 by a solution of potassium carbonate (non-toxic and non-polluting reagent) which is continuously regenerated and reused. All the electricity and heat necessary for the "steam explosion", the operation of the digester and the biogas upgrading come from a biogas plant, in operation at the same company since 2012, fed with more conventional biomass (residues of agri-food production, livestock manure, silage, etc.). The residual biomass of both anaerobic digestion plants (digestate) is used as a soil improver on the agricultural land of the company (3,000 ha) and neighbours, returning to the soil all the organic matter not used for the production of energy and biomethane with a perfect example of circular economy.

ABOUT BRANCHES

BRANCHES is a H2020 "Coordinaton Support Action" project, that brings together 12 partners from 5 different countries. The overall objective of **BRANCHES** is to foster knowledge transfer and innovation in rural areas (agricolture and forestry), enhancing the viability and competitiveness of biomass supply chains and promoting innovative technologies, rural bioeconomy solutions and sustainable agricultural and forest management.

COORDINATOR: Johanna Routa - (Luke) johanna.routa@luke.fi
DISSEMINATION: itabia@mclink.it

www.branchesproject.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101000375

THE PARTNERSHIP

Luke Luonnonvarakeskus
National Research Council of Italy Institute of BioEconomy Department of Biology, Agriculture and Food Science
VTT
University of Warmia and Mazury in Olsztyn
DBFZ
circe Research Centre for Energy Resources and Consumption
ITABIA Italian Biomass Association
MTK
aveBiom Spanish Biomass Association
UFZ
W-M ODR
BioEconomy Cluster