

New process quickly transforms livestock manure into biochar

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The MTB Installed at the Demonstration Site. Credit: KOREA INSTITUTE OF ENERGY RESEARCH

A technology has been developed to quickly convert livestock manure, a significant issue in animal farming, into valuable "black gold" rich in

carbon within a day.

Dr. Yoo Ji-ho and his research team from the Clean Air Research Laboratory of the Korea Institute of Energy Research (KIER) have developed a process that immediately converts livestock manure into biochar (biomass and charcoal) at livestock farms. Using the process developed by the research team, it is possible to convert 10 tons of livestock manure into biochar in a single day.

As of 2022, the amount of livestock manure produced was about 50 million tons, of which 87% is used as compost and liquid fertilizer after being fermented over a long period. However, during this long treatment process, which can last more than 60 days, [nitrous oxide](#) (N_2O), a [greenhouse gas](#) 300 times stronger than carbon dioxide, is emitted.

Additionally, ammonia (NH_3), which causes ultrafine dust and odors, is also released, accounting for 70% of the [total emissions](#) nationwide. This has led to persistent odor complaints, becoming a chronic problem for livestock farmers.



Group Photo of the Research Team (third from the left in the top row, Chief Researcher Yoo Ji-ho). Credit: KOREA INSTITUTE OF ENERGY RESEARCH

Biochar is gaining attention as an alternative solution to overcome these issues. Converting livestock manure into biochar not only completely prevents the emission of nitrous oxide and ammonia but also absorbs carbon from the air and can sequester it, making it a viable means to achieve carbon neutrality in the livestock sector.

Consequently, the government has designated biochar as a core technology area for carbon neutrality in the livestock sector and plans to expand the use of biochar and improve manure management in livestock

farms through the "Livestock Sector 2030 Greenhouse Gas Reduction and Green Growth Strategy"

The core of the Manure To Biochar (MTB) process developed by the research team is a dehydration and drying technology that reduces the [moisture content](#) in livestock manure, which is over 80%, to less than 20%.

The research team successfully designed and built an integrated system that combines the drying process owned by the KIER, the dehydration process from the Korea Institute of Machinery and Materials (KIMM), the pretreatment process from DULI TECH Co., Ltd., and the pyrolysis technology from YOUGI IND Co., Ltd. to achieve optimal performance. Using this, the overall energy consumption can be significantly reduced to less than one-tenth compared to the conventional rotary kiln method.

The process begins with a screw-type solid-liquid separator developed by the KIMM. This separator reduces the moisture content in livestock manure, which is over 80%, to less than 60%. The energy used in this step is minimized to 1% of that used in conventional heat-based processes like the rotary kiln method (horizontal, cylindrical). The separated manure chunks are then finely crushed to less than 1 cm in size by a three-stage blade crusher developed by DULI TECH Co., Ltd.

This process has been demonstrated at a pilot site in Cheongyang County, Chungnam, capable of handling 10 tons of livestock manure per day. The research team successfully completed 100 hours of process operation, proving its commercial viability. In particular, the F-COMB drying device developed by the KIER is highly competitive in terms of energy efficiency, production cost, and convenience.

Plans are in place to scale up to more than 100 tons per day to meet domestic demand as well as international demand from China, Australia,

and Indonesia, who are pushing for environmentally friendly waste management and recycling.

Most of the livestock manure in Korea is being composted, and there is a lack of measures to reduce the greenhouse gases and ultrafine dust particles that are emitted during this process. The process we developed is a low-cost, high-efficiency process that can immediately convert [livestock manure](#) into [biochar](#) on-site, serving as a key technology to prevent environmental problems in the [livestock sector](#) and emissions of greenhouse gases.

Provided by National Research Council of Science and Technology

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