

## Activities

Three different methods of applying biochar to pig slurry storages (MatChar, FiltChar and AeroChar) were investigated to identify the best treatment for GHGs ( $N_2O$  and  $CH_4$ ) and  $NH_3$  reduction. Research also investigates the possibility to use the exhausted biochar (the biochar used to reduce emissions from the slurry storage) as nitrogen-rich soil amendment.

An economic and LCA analysis were carried out to evaluate the economic feasibility of the most promising methodology.

## Further details

- € **Total budget:** € 193.830,50
- Total financed:** € 180.000,75
- Main funding source:** Rural development 2014-2020 for Operational Groups
- Rural Development Programme:** 2014IT06RDRP003 Italy - Rural Development Programme (Regional) - Emilia-Romagna
- 🕒 **Ended,** 2021 - 2023
- 📍 **Emilia-Romagna, Italy**
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## Char Rimedio

# Use of biochar to reduce ammonia and GHG emissions from pigs livestock


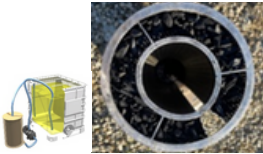



## Objectives

Evaluate which application process of biochar (recalcitrant carbon by-product from the gasification process of woody and residual biomass) is the most efficient in reducing ammonia emissions from the storage of pig slurry.

Investigate the improved fertilizing characteristics of biochar for agronomic use thanks to the micro and macronutrients adsorbed and bound following contact with the pig slurry.

### Biochar application processes

Type of treatment	Description and action mechanism
<b>MatChar</b> 	<b>Floating mats to cover storage</b> Thanks to a physical containment action, floating mats prevent the diffusion of gases and odors from the liquid matrix to the air. Floating mats can be easily positioned on the surface of the slurry and follow its level variation. MatChar, thanks to the mechanisms of absorption and adsorption of gaseous molecules, could further reduce emissions compared to plastic cover systems.
<b>FiltChar</b> 	<b>Hermetic adsorbent filter crossed by the slurry</b> The slurry passes through the biochar, which acts as a filtering material and adsorbent of gases and other elements. Filtration with biochar, used as a carbon filter, to reduces emissions through different mechanisms: electrostatic attraction, ion exchange, cation exchange, adsorption, absorption, formation of active biofilms on the surface.
<b>AeroChar</b> 	<b>Biochar as a substrate for the growth of nitrifying-denitrifying bacteria</b> The reactor contains biochar inoculated with nitrifying and denitrifying bacteria. At regular intervals the reactor containing biochar is filled with slurry (anoxic phase) and after 30 minutes emptied of slurry (aerobic phase) in alternating phases. The principle of biological removal of nitrogen with activated sludge using the SBR (Sequential Batch Reactor) technique is exploited: aerobic (nitrifying) phases alternate with anoxic (denitrifying) phases.

## Results

The application of biochar to slurry contributes to reduce the carbon footprint of the supply chain only if the subsequent valorisation in the field is considered thanks to the sequestration of CO<sub>2</sub> in the soil by the biochar.

Thanks to the covering effect of the slurry storage, ammonia emissions were reduced by 32% with the MatChar application compared to uncovered storage. The AeroChar treatment was effective in reducing methane and nitrous oxide emissions (-17% and -10% respectively) for the oxygenation of the slurry during the nitrification process. Filtration of slurry through a biochar filter (FiltChar) is the least promising application in mitigating emissions.

After interaction with pig slurry, biochar is more suitable for subsequent agronomic use for fertilizing purposes (pH, C/N and TOC) and the N and P content is significantly increased. The economic sustainability of the application of biochar to slurry, to reduce emissions and to sequester CO<sub>2</sub>, could become positive if the procurement price of biochar fell to €80/t.

## Context

Pig breeding in Emilia-Romagna (Italy) is an important economic activity, which gives rise to food excellence linked to the territory.

12.1% of the pigs raised nationally are concentrated in the region, equal to 1,024,215 pigs (www.vetinfo.it, 2022).

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Location in the Nutri-Know value chain



Unfortunately, the management of pig slurry generates environmental impacts: ammonia, GHG and odors emission. Char Rimedio OG has the aim of contributing to the mitigation of emissions resulting from the storage of slurry. Lagoons containing pig slurry are still widespread in regional pig livestock, for which fixed covering techniques, applicable on concrete storage to reduce emissions, are in most cases technically unfeasible and economically unsustainable. In these cases, it is necessary to identify alternatives that allow a reduction in ammonia and greenhouse gas emissions.

The introduction of biochar from gasification in the livestock effluent management chain is interesting for the valorization of biochar in agriculture as a soil improver enriched in nitrogen, phosphorus and micronutrients, thanks to the interaction with pig slurry and as a means to sequester CO<sub>2</sub> in the soil.



# NUTRI•KNOW

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