# Biochar in Poultry Farming

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www.ithaka-journal.net/pflanzenkohle-in-der-geflugelhaltung?lang=en

**Poultry industry is struggling more and more with livestock disease.**
**Often this is traced back to microbial pathogens and ammonia in the litter.**
**Addition of highly porous biochar can reduce toxic ammonia pollution in the coops, and regulate moisture level of litter.**
**Biting coop odor and footpad dermatitis in poultry can be prevented in just a few days.**
**Biochar added to feed can deactivate toxins already in the digestive system.**
**Intestinal flora is positively activated, and animal vitality improves rapidly and markedly.**

Industrial poultry farming places extremely high demands on hygiene of the coops, of the air in the coops and of the feed, as well as of waste and faecal matter. High animal densities increase the pathogen pressure as the immune response of stressed animals is weakened, with the result that more pathogens are excreted. The smaller the area in which the animals are kept, the more the microbial environment in the coop is dominated by microbes that live off the animal itself and its excretions. This produces a significant risk of spreading germs, which is exacerbated by poor coop and feeding hygiene.

If, in addition, the poultry is treated with anti-infection and antibacterial agents, this creates an environment that selects pathogens that are resistant to the drugs being used. Because these events depend on the quantity of pathogens (pathogen pressure), it is all the more important to control the coop environment in a timely manner so that pathogen pressure is reduced.

Due to the loose housing of poultry, animals in coop systems inevitably live in constant contact with their excrement. The extremely nutrient-rich and humid faeces create ideal conditions for multiplication of pathogenic microorganisms. Added to this, microbial decomposition of excrement leads to significant emissions of ammonia. The pungent-smelling gas is harmful to animals because it irritates mucous membranes, attacks lungs, weakens the immune system, and even accumulates in blood. Besides effects on animal welfare, performance also deteriorates seriously. Last but not least, ammonia emissions are environmentally harmful. Via nitrogen return in rain, they produce highly climate-damaging emissions of nitrous oxide, soil acidification and eutrophication of water bodies.

Use of biochar as feed additive and litter can significantly minimize problems described, both with animal health and environmental performance.

## Instructions to use of biochar in litter

Biochar has a very high water holding capacity and can absorb up to 5 times its own weight of water. Biochar adsorbs very efficiently both organic molecules such as amino acids, fatty acids, proteins and urea and also mineral compounds such as ammonium, ammonia and nitrate. Used in litter, biochar locks in moisture and organic and inorganic nitrogen compounds. The nitrogen adsorption and the continuous drying of the litter deprive the microbial pathogens of their nutrient base and reduce toxic emissions of ammonia. After just a few days, a significant reduction in coop odour can already be noticed.

With the lowering of the moisture content and ammonia contamination the risk of footpad diseases decreases. Existing infections begin to heal. Animals' resistance increases, with a positive effect on their vitality, egg production and final body weight.

Biochar's high adsorption capacity makes it possible to reduce the use of lime in litter, thereby reducing pH of litter and manure, which in turn reduces ammonia emissions.

## Footpad diseases

Turkeys and broilers frequently suffer from leg weakness syndrome, which, last but not least, is economically disastrous. To this should be added footpad inflammation, known as "footpad dermatitis" (pododermatitis). Causes of these inflammation reactions are multifactorial, but the main causes are high levels of ammonia (NH3) and overly damp litter. Particularly important in this respect are the structure and hardness of the litter, both of which are improved by use of biochar.

Effects of footpad diseases include pain, reduced physical activity, reduced feed and water intake, growth depression, feather pecking/cannibalism, reduced carcass quality and increased mortality.

## Application of biochar

The biochar should, depending on the type of litter, be mixed 5-10 vol % with the usual litter. The char is first moistened in order to prevent dust formation. Ideally it is applied in the form of lactic acid biochar bokashi. When using straw pellets as litter, the char is best added already at the pelleting stage.

If silage is used as litter, the char can already be added at the ensiling stage. In this way, dust formation can be avoided entirely, and the low pH of the silage kills off pathogens. Mixed into silage, the char is bound very well and no longer rubs off onto the animals' feet. This is particularly important in egg farms, since coal can rub off from the hens' feet onto the eggs.

## Use of biochar in feed

In addition to its use as a litter additive, biochar, and in particular biochar bokashi, is also used as a feed supplement. Biochar promotes digestion, improves feed efficiency, and thus in particular energy absorption via the feed. Toxins such as dioxin, glyphosate, mycotoxins, pesticides and PAHs are efficiently bound by the biochar, thereby obviating any adverse effects on the digestive system and intestinal flora. Health, activity and balance of animals will also improve, as will meat and egg production. With animals' immune systems stabilized, the risk of infection from pathogenic micro-organisms decreases.

The huge economic impact of diarrhoeal diseases in poultry is well-known. Causes of these diseases are often of an infectious nature, caused by, among others, E. coli, clostridia, coccidia and mycobacteria. Of particular importance are salmonella and campylobacter germs; while rarely causing disease in poultry, they can do so in humans. In particular, non-infectious causes of disease are poor feed quality and biocide contamination of feed, as when herbicides are used to siccate feed grain, or to treat weeds during growing GMO corn or soy feed. Consequences are increased susceptibility to disease, growth depression, infertility and digestive disorders.

Numerous factors are responsible for the stabilization of the intestinal milieu. Of particular importance here are the stabilization of the intestinal barrier and the functionality of the liver. Numerous bacteria such as lactobacilli and enterococci, but also non-pathogenic yeasts play an indispensable role here. Feeding biochar and biochar bokashi can stimulate the activity of these desired microorganisms in the digestive system. The benefit of the biochar lies therefore not least in its ability to relieve in particular the liver-intestinal circuit.

Charging of biochar with specific lactobacilli to direct the symbiosis in the gastro-intestinal tract of farm animals can further potentiate the effect of biochar. Biochar bokashis produced as ready-made feed on the basis of a fermented biochar, wheat bran and herbs are an important feed supplement for maintaining and enhancing performance in animal production.

According to studies by Van (2006), addition of up to 0.6% biochar in feed improves growth in young animals by an average of 17%. Similar results are confirmed by Kana (2010) and Ruttanvut (2009) for ducks and broilers. No systematic scientific studies of long-term effects exist yet.

It's recommended to mix 0.4%–0.6% biochar to the usual feed. With laying hens, the feed supplement should be suspended for 2-3 days every 10-15 days. Biochar bokashis, such as Carbon-Feed from Swiss Biochar, should be added 2% – 3%% to the usual feed. If biochar is already used in the feed, the amount of biochar in the litter can be reduced accordingly.

## Biochar use to improve manure quality

Above-mentioned effects of biochar to store moisture and nutrients also mean poultry manure is better degraded microbiologically. Carbon and nitrogen losses are significantly reduced, and with them, emission of greenhouse gases (Steiner 2010). Fertilizer quality of the poultry manure increases strongly as a result of biochar, and odor pollution can be reduced significantly, which increases the marketing potential of poultry manure.

If biochar is used neither in litter nor feed, it's advised to sprinkle it in a ratio of 10 vol % on the manure belt.

If the poultry manure is used for energy production in biogas units, the addition of biochar both increases the methane yield and improves the fertilizing quality of the digestate. Poultry manure can also be directly pyrolyzed to produce biochar and energy.

## Literature


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