New ecological and economic horizons in poultry

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Abstract. The article discusses the reduction of harmful emissions into the environment, the production of organic (bio) products, with increasing demand from the population, describes the experience of using an adsorbent - activated carbon in poultry farming, and provides biochemical data on the effectiveness of our method. The authors analyze various types of pollution, highlighting the role and importance of harmful emissions in the agricultural sector. Moreover, as the researchers note, there is a demand for environmentally friendly agricultural products. The global environmental problems, a significant part of which is the utilization and use of litter, makes us look for ways to reduce harmful factors in poultry farming. On the other hand, the consumption of nitrogen fertilizers in crop production requires metered application. The use of organic fertilizers with the addition of adsorbents is more effective, since the desorption process allows you to saturate the soil with nitrogen gradually, without polluting the sown area.

1. Introduction
Pollution is a process of negative modification of the environment - air, water, soil - through its intoxication with substances that threaten the life of living organisms. Sources of pollution emitted by livestock and poultry enterprises into the environment are divided by type into the following:

- gas and dust emissions - products of decomposition or burning of organic waste: microorganisms, dust, organic compounds, oxides of nitrogen, sulfur, carbon;
- wastewater containing a polydisperse mass with solid inclusions of dust, lint, feed residues, as well as nitrogen, nitrates, chlorides, sulfates, phosphates, pathogenic microbes, fats, iron, bacteriological and chemical pollutants, oil products;
- organic waste products (manure / litter) with many microorganisms;
- non-food waste from animal processing: feathers, hides, entrails, veterinary confiscations, low-value products, as well as dead animals [1].

An agricultural enterprise is a complex natural-technical system that, on the one hand, uses natural resources (land, water, air) to solve most production problems, and on the other hand, vital products are allocated (accumulated) in the process of using these resources, one of which have a beneficial effect on the environment, others pollute it (Figure 1).
Figure 1. Natural-technical system of an agricultural enterprise.

The main sources of environmental impact of an agricultural enterprise are: emissions of pollutants into the atmospheric air, acoustic effects, thermal effects, pollution of soils, subsoil, discharges of pollutants into water bodies, waste disposal, etc.

The lack of industry for the processing and use of poultry waste in agricultural enterprises leads to the accumulation of huge quantities of litter, which are serious sources of environmental pollution.

In the total volume of atmospheric pollutants as a result of anthropogenic activities (energy, transport, industry, domestic needs and agriculture), emissions of agricultural production proper, in addition to ammonia, make up less than 10% in developed countries. According to various estimates, the main source of ammonia emissions into the atmosphere is 80–90% of litter (manure) handling systems in agricultural production. According to the enlarged initial data, the damage caused to the environment by agricultural production in Russia as a whole amount to more than 500 billion rubles per year, of which about 90% are in litter (manure).

Despite the fact that the ecological situation is not developing in the best way, demand for poultry farms is growing, especially for organic products. So all over the world, in 2008 world sales of these products amounted to 52 billion dollars, in 2020 they forecast about 143 billion euros.

With regard to the market of organic products in Russia, there is a very high demand, which is several times higher than the supply. Demand in the Russian market is growing 23% faster than demand in the global market. According to RosIndex, 94% of Russians regularly eat poultry meat. Currently, there is an opportunity to grow a niche of organic products, including poultry farming in Russia.

Accepting the above, we are working to reduce the emission of harmful substances into the environment using natural materials. Our goal is to obtain organic poultry products and reduce the toxicity of by-products (litter).

2. Materials and methods
The methods that we used to study the emission of harmful emissions in the house during broiler cultivation are empirical, statistical-economic, and also biochemical.

The materials in this experiment are - broilers Ross 308, floor content with litter of sawdust and activated carbon. With a standard diet and feeding, temperature and humidity conditions and artificial lighting.

3. The results of the study
Daily chickens weighing from 40.5 g to 50.5 g were divided into 2 groups in each group of 102 chickens. We placed it on the floor, in the experimental batch, sawdust was added to the sawdust with a moisture content of 7% at the rate of 3 g per 1 m². The air was measured with the “Comet M” instrument. The results are shown in table 1.
Table 1. Air measurements for broiler chickens.

| Date       | 16.01.2020 |
|------------|------------|
| Age        | 1 day      |
| Sampling time | 12:00:00   |

| Device | Comet M |
|--------|---------|
| Units rev. | PCS % mg mg % % °C |
| name    | Number of heads CO₂ NH₃ H₂S CO O₂ t |
| control | 102 0.12 6 0 4 21 37 |
| experience | 102 0.13 6 0 4 20.9 38 |

Further measurements of NH₃ were made on days 21, 28, and 35 as a result; when measuring air in the house, it was recorded that the ammonia emission in the experimental group was 23% lower than in the control, and H₂S 30% lower.

Indirect emissions are known to occur as a result of the loss of volatile nitrogen, mainly in the form of ammonia and NOₓ. Part of the released organic nitrogen, which is mineralized to ammonium nitrogen during the collection and storage of manure, depends mainly on time and to a lesser extent on temperature. Simple forms of organic nitrogen, such as uric acid (poultry), are rapidly mineralized to ammonium nitrogen, which is highly volatile and diffuses readily into the surrounding air [2,3].

However, analyzing the data on the litter, there is a positive work of the adsorbent, which can be seen from the above figure 2.

![Figure 2. Analysis of litter data from day 7 to day 35, %](image)

Because Coal is a physical adsorbent, that is, adsorption is due to intermolecular interaction forces: it is reversible. Therefore, when using litter from sawdust with coal and litter, all adsorbed substances, including ammonia, will gradually pass into a free state, thereby enriching the soil with nitrogen-phosphorus fertilizer [4].

Vegetable raw materials enriched with nitrogen from bird droppings have high fertilizing qualities and are used for the simultaneous utilization of waste from poultry farms and hydrolysis industry [5].

As for the main products, the experience showed that the increase in poultry mass by day 35 in the experimental group was 6.4% higher than in the control. Laboratory studies of poultry meat are shown in table 2.

Table 2. Laboratory studies of poultry meat are shown in.

| Try | Indicators | Control | Experience | Unit measuring |
|-----|------------|---------|------------|----------------|
|     | moisture   | 76.7    | 75.94      | %              |
### Pectoral and thigh muscles

|                | Crude protein | Crude fat | Crude ash | Vitamin A | Vitamin E | Vitamin B2 |
|----------------|--------------|-----------|-----------|-----------|-----------|------------|
|                | 89.55%       | 3.33%     | 4.14%     | 109.7 mcg/g | 4.03 mcg/g | 11.28 mcg/g |
|                | 90.31%       | 2.9%      | 4.23%     | 79.58 mcg/g | 4.25 mcg/g | 11.58 mcg/g |

### 4. Conclusion

It can be seen from the experiment that the use of an adsorbent (activated carbon) has a positive effect on poultry growth, the biochemical composition of the main product and by-products in the form of fertilizers, which are more enriched with nitrogen and other trace elements and the use of a physical adsorbent allows prolonged effect on the soil.

Moreover, the environment is less exposed to pollution.

### References

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