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BIOTESTING OF VOLATILE ORGANIC COMPOUNDS FROM QUAIL LITTER

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Abstract

The study investigated the effect of volatile organic compounds (VOCs) emitted by quail litter on various test organisms. Odors from litter are a significant problem, and their content, changes in VOC composition in dynamics and impact on biota are not well-studied. In biotesting, parameters such as cell viability and physiological characteristics were evaluated. Biotesting conducted on typical test objects revealed the hazard of VOCs to biota. The results are discussed in the context of VOC composition and public health safety.

Poultry farming is accompanied by waste, including litter, which is hazardous to the environment when accumulated. There are various approaches to the storage and disposal of such waste, the primary objective of which is to make the waste safe. Most often poultry waste is fermented, composted, and microbiological preparations are used to decompose the waste. A particular problem is the strong specific odor of poultry litter. Often litter is stored and volatile organic compounds (VOCs) affect the environment for a long time. The aim of this study was to conduct biotesting of VOCs from quail litter.

The unicellular green alga *Chlorella vulgaris* M. Beijerinck, isolated from communities developing on the surface of rocks and clay sediments in the fotic zone of the Waz-Abaa cave, was selected as a test object. The object was chosen because the alga is often used for biotesting, and the entrance zones of caves located in places where anthropogenic impact is minimal are among the reference habitats. *Chlorella vulgaris* was isolated from natural communities, cultured in Bristol medium (Hollerbach's modification) at 24 °C, under 30–40 μmol·m^{-2}·s^{-1} illumination. A 1 ml suspension of algae was applied to the surface of Bristol agarose medium in a Petri dish and evenly distributed on the surface; after 24 hours the dish was placed into the box with litter. The initial concentration of *Chlorella vulgaris* was 10^6 cells/mL, the exposure time was 7 days, and the result was evaluated on days 7, 14, and 21. The experiment was conducted under natural light. The change in cell number was determined in comparison with the control. Control measurements were conducted in the same way without VOCs. To analyze the number of cells, the number of cells was calculated with a light microscope on 1 cm^2 of the medium surface at 5 points on the diameter of Petri dish. Lyophilized luminescent bacteria («Ecolum» test system) was also used for biotesting. The test system was poured onto a Petri dish with agarose substrate and put into the box with litter for one hour.

The result revealed a decrease in cell numbers of 70 ± 3 % on day 7, 80 ± 2 % on day 14 and 90 ± 1 % on day 21. The toxicity index of litter was 48–62 on day 7, 51–64 on day 14 and 46–56 on day 21, these are the toxicity and strong toxicity indices of the sample.

It was previously determined by mass spectrometry that the VOCs of poultry litter predominantly contain sulfur compounds (sulfur (IV) oxide, dimethyl sulfide, mercaptan, disulfide) as well as alkenes (butene, isoprene, isoctene), isopropanol, limonene, ethyl acetate, trimethylamine, indole, diethyl ether, tetrahydrofuran, and dioxane derivatives. It is obvious that these compounds, accumulating in the volume of the box, create a toxic effect and lead to the death of soil algae [1, 2]. Thus, it can be concluded that VOCs of litter not only cause unpleasant odor, but also are hazardous for the population living near the places where quail litter waste is stored.

References

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