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MICROBIOLOGICAL FOUNDATIONS OF ENVIRONMENTAL SAFETY IN PIG PRODUCTION SYSTEMS

MONOGRAPH



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The monograph is devoted to the scientific substantiation and development of microbial biotechnologies for pig manure bioconversion, reduction of harmful gaseous emissions, and improvement of the sanitary and hygienic conditions in pig housing facilities. The results of studies on pig manure and bioaerosol microbiota, nitrogen transformation, and the effectiveness of a microbial biodestructor are summarized.

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ABSTRACT

This monograph presents a comprehensive study of the microbiological, environmental, and technological aspects of organic waste bioconversion in modern pig production, with a particular focus on the development and application of a microbial biodestructor to improve the sanitary and hygienic conditions of pig housing facilities and reduce the adverse environmental impact of livestock waste.

The first part of the monograph examines livestock organic waste as a habitat for microbial communities, the formation of microbial consortia in pig slurry, the characteristics of probiotic microorganisms outside the animal host, and the role of microbial consortia in organic waste bioconversion processes. The prospects for the application of environmental biotechnologies in modern pig production are substantiated.

The second part focuses on the environmental and microbiological aspects of air pollution in pig farms. The patterns of accumulation of harmful gases and bioaerosols, their significance for the microclimate and the health of animals and humans, the potential dissemination of antimicrobial-resistant microorganisms and resistance genes, and modern approaches to odour control are considered. Microbiological processes occurring in pig manure and associated with the formation of gaseous compounds and odorous emissions are analyzed, along with the role of microbial biodestructors in regulating these processes.

The third part presents the results of the experimental rationale and development of a microbial biodestructor for improving microclimate conditions in pig housing facilities. The microbiological characteristics of bioaerosols in pig finishing barns were investigated, criteria for selecting microorganisms for the biological preparation were substantiated, and nitrogen transformation processes in pig manure during its accumulation in underfloor manure pits were characterized. Changes in major microbial groups and the dynamics of ammonia, nitrites, nitrates, and total nitrogen were determined.

The findings demonstrate that application of the microbial biodestructor contributes to the optimization of the microbial composition of pig manure, promotes the development of beneficial microorganisms, and suppresses undesirable microbiota. A slower accumulation of ammonia, changes in the transformation of nitrogen compounds, and greater retention of total nitrogen in manure were observed. The application of the biodestructor also reduced concentrations of ammonia and hydrogen sulfide in the air of pig housing facilities, as well as the levels of bacterial and fungal contamination.

The fourth part of the monograph evaluates the effectiveness of the microbial biodestructor in reducing airborne microbial contamination in pig housing facilities. The results of its practical application are summarized, demonstrating its potential to improve sanitary and hygienic parameters of the microclimate, reduce concentrations of undesirable microorganisms, and decrease gaseous pollutants.

The findings provide a scientific basis for the application of microbial consortia in pig manure bioconversion technologies and for regulating

microbiological and biochemical processes in pig production systems. The proposed approaches are aimed at reducing the environmental impact of livestock farms, improving the sanitary condition of the production environment, and promoting the rational utilization of organic waste as a potential resource for further agricultural use.

Keywords: pig production, pig manure, organic waste, bioconversion, microbial consortium, microbial biodestructor, bioaerosol, microclimate, ammonia, hydrogen sulfide, nitrogen transformation, microbiota, antimicrobial resistance, environmental biotechnology.

PART 1. MICROBIOLOGICAL BASIS OF ORGANIC WASTE BIOCONVERSION IN MODERN PIG PRODUCTION

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