

SUMMARY OF DOCTORAL THESIS

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Development of products to improve the welfare of poultry based on plant biomass extracts

In the modern agri-food industry, disinfectants are very commonly used and new solutions are constantly being sought to combat microorganisms. Disinfection aim is to remove unwanted microorganisms in order to protect against their dangerous and often fatal effects. In poultry farming, washing and disinfection procedures take place after each completed production cycle, which usually lasts 6 weeks. The agents used must act quickly and effectively, and at the same time be economically available, so that the profitability of breeding is maintained. At the same time, microorganisms are becoming more and more resistant to the agents used, which necessitates the use of increasingly higher doses or combinations of substances with increasingly stronger effects. All disinfectants are classified as hazardous to health and the environment, including carcinogenic or mutagenic effects. This causes problems with application and a constant increase in costs. Despite professionally conducted disinfection procedures, contamination in the breeding cycle is still a problem and in each cycle there is a fight for the lowest possible losses resulting from bird illnesses or deaths. The sources of contamination are the birds themselves, which can enter the hen house as carriers of microorganisms, but there are also external factors, such as the litter, water, food, air, surfaces of the hen house and humans, who are often the vectors of infection. Chicken breeders and employees of companies providing cleaning and disinfection services for hen houses, assume that some contamination may be secondary, i.e. transferred from the completed breeding cycle to the next one, despite disinfection procedures. The reason why the disinfection procedures do not reach all the nooks and crannies, e.g. micro-damages in concrete is the construction of the hen houses and the structure of their surfaces. It becomes a place where microorganisms remain and attack a new batch of chickens.

The fight against microorganisms can also be carried out from the inside, i.e. by stimulating the immune system of the hens to fight infections. In addition to traditional pharmaceuticals, substances that naturally occur in nature can be used for this purpose. Numerous studies on the influence of substances of natural origin are conducted. These studies prove that natural substances, when added to food or water, help building the hens' immunity.

As the core of this industrial doctoral thesis, two research directions, inspired by the above mentioned problems, were combined:

1. Development of a solution enabling the isolation of microorganisms that could remain on the surface of the hen house after the completed breeding cycle despite its cleaning and disinfection. It would be isolation from microorganisms that can be dangerous to the new broiler breeding cycle;
2. Introduction of active substances from herbal plants during the breeding of hens in a different way than by food or water, so that they could stimulate the immune system of the hens.

As a solution, product in the form of a coating to be applied to the floor and walls of the hen house was proposed, which would contain extracts or oils from plants previously used in poultry feeding and known for their health-promoting properties.

The research was divided into stages:

1. Development of a coating formula which, when applied to the concrete floor and walls of the hen house, will create an isolating layer against pathogens;
2. Obtaining active substances from herbal plants by extraction and distillation, taking into account the technological possibilities for large-scale production;
3. Enrichment of the coating formula with the obtained extracts and/or oils;
4. Conducting experimental breeding of hens in test chambers to observe the effect of using the coating product on environmental conditions and poultry welfare;
5. Breeding in large-scale hen houses using the coating product to compare zootechnical parameters and poultry welfare in usually used conditions.

The research was conducted using the following plants: common thyme (*Thymus vulgaris*), rosemary (*Rosmarinus officinalis*), oregano (*Origanum vulgare*), common sage (*Salvia officinalis*), common nettle (*Urtica dioica*) and knotweed (*Polygonum aviculare*). The active substances were obtained by extraction in a Soxhlet apparatus and water distillation in Clevenger apparatus. The properties of extracts and essential oils were checked by spectrophotometric analyses (Folin-Ciocalteu and ABTS methods) and chromatographic analyses (UPLC, GC-FID).

As a result of the research, a coating product containing rosemary oil was developed and implemented. The product has a positive effect on the welfare of poultry in broiler breeding.