

Evaluating the effectiveness of filter media in the treatment of poultry wastewater

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Abstract. The technology of sorption treatment of wastewater of poultry farms is considered. A comparative assessment of two ameliorants in terms of chemical absorption properties is carried out. The result of a comparative assessment of two natural sorbents for the sorption properties of heavy metals, shows that the best absorption effect has a natural zeolite. Natural ameliorant adsorbed in the studied effluents more than 60 percent of harmful impurities at optimum contact time of 12 hours of stay in the aggressive liquid medium of waste water, and activated charcoal showed less effective properties of sorption of chemical impurities. Experimental data focuses on reducing the environmental load of water bodies in which wastewater is discharged.

1 Introduction

At present, the state of surface and ground water is a cause for concern, since its quality does not meet the standards of sanitary supervision [1, 3, 4, 12, 13, 22]. The reason for this is that wastewater is not treated in good faith and discharged into rivers, lakes, etc. When studying the qualitative indicators of water analysis, shows an increased content of toxic substances in the form of metals, sulfates, nitrates, ammonium, petroleum products.

Wastewater is treated by a variety of methods, such as reagent, nonreagent, filtration, cascade filtration, multistage, sorption [2, 3, 5, 11, 14, 17, 20].

The best in terms of technical and economic prevalence are processes of sedimentation and filtration, as in these methods of loading show better properties of sorption and adsorption of all chemical and part of the mechanical impurities.

The process of capturing a liquid or solid phase of the substance by the sorbent is due to its crystal lattice, the surface of which is pierced with numerous holes in the form of pores. Due to this structure of the filtration material allows you to perform an effective and high-quality degree of purification of waste water poultry compass [6, 7, 8, 9]. The absorption process depends a lot on the properly selected sorption material, its grain size, crystal lattice, porosity, resistance to chemical environment.

The water absorption capacity of the selected sorption ion-exchangers is affected by factors such as residence time in aqueous medium, hydrogen index, volume capacities, etc.

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There are several types of volumetric capacities - these are static, absolute and dynamic [10, 15].

When selecting filtration material and its quality of treatment of poultry wastewater in relation to toxic heavy metals and ammonium ions, all the above parameters are required [16, 18, 19, 21]. Zeolite, also called aluminosilicate, has a good static capacity for ion exchange. Aluminosilicate has a porous structure and well-developed crystal lattice, which allows it to be highly selective to ions of large sizes. Optimal contact time of aluminosilicate with soluble substances is necessary for complete absorption of harmful substances from wastewater. There are many sorbents in the world today, both natural and synthetic. The most high-quality and durable are natural sorbents, in the study of the absorption properties of zeolite, wood activated carbon, were studied their properties of removal of heavy metals.

To study the most effective sorbent for the absorption of chemical impurities were determined under static conditions.

2 Materials and methods

When studying the moisture-absorbing properties of zeolite and activated charcoal, the standard method for determining static conditions was used. Before performing the experiment, it is necessary to prepare containers for the introduction of the sorbent under study, add poultry wastewater, stir for a few seconds to manifest the reaction of the sorbent with the liquid medium, then separate the liquid phase from the solid phase by settling, filter the solution and perform photocolometric analysis of the filtrate.

The volume of wastewater was taken in equal amounts, for this purpose measuring flasks were used, in which each sorbent was added in equal proportions, the experiment was conducted under laboratory conditions.

3 Results

In experimental studies, all of the studied ion-exchangers showed absorptive properties in varying degrees. After calculating the static capacities of each of the studied sorbents, we showed that the best sorbent in terms of absorption properties is aluminosilicate (zeolite). After completed experimental studies for 48 hours, the best moisture-absorbing effect was observed for zeolite after 12 hours of contact with poultry wastewater it removed 64.7 percent of total iron, and activated carbon only 15.4 percent. Contact for 48 hours, showed that the aluminosilicate (zeolite) has reduced its sorption capacity to 54.6 percent, as there was saturation of the crystal lattice, and the activated carbon to 3.1. Therefore, the best contact time of the sorbent with the liquid phase is observed within 12 hours. All of the ion-exchangers studied, showed their sorption properties in different percentages, the results of which are shown in Figure 1, 2.

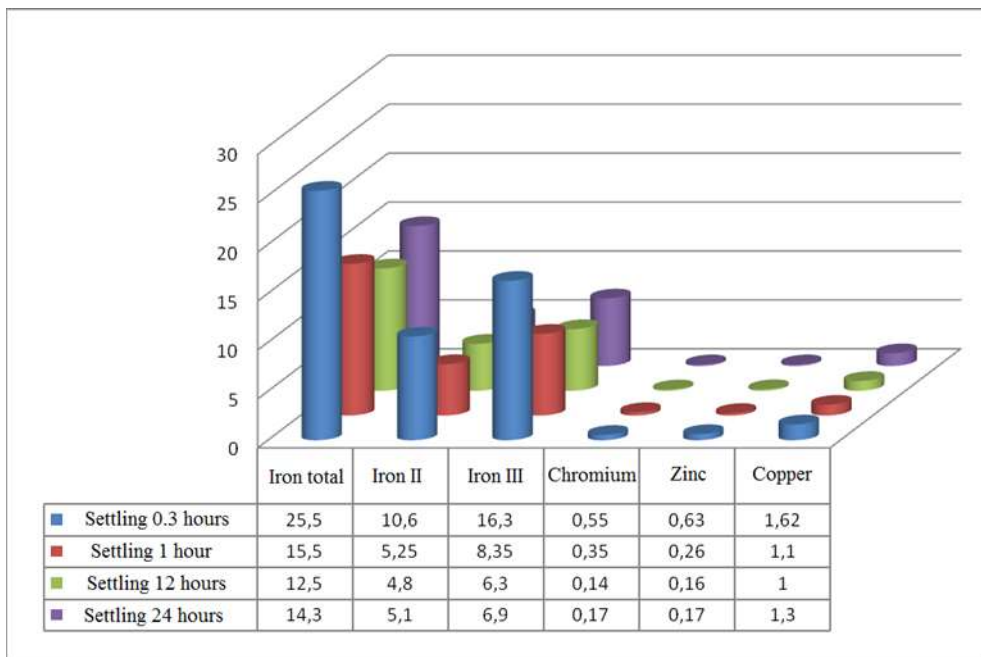


Fig. 1. Changing the concentration of chemical impurities at different time intervals on the example of zeolite.

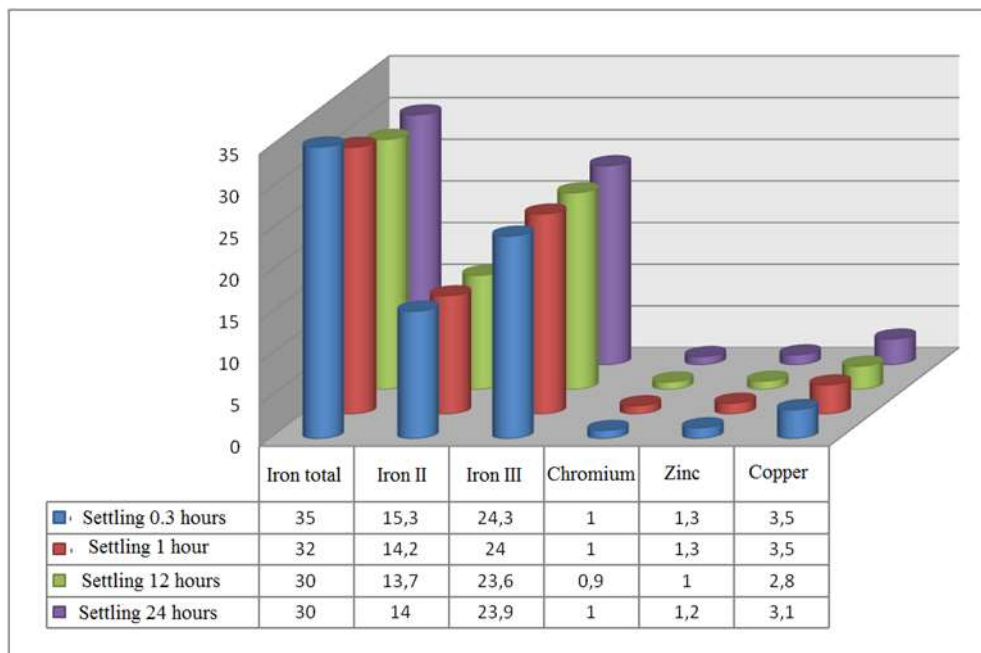


Fig. 2. Changing the concentration of chemical impurities at different time intervals by the example of activated carbon.

According to the data obtained the statistical processing of experimental data were obtained dependencies, presented in the form of a power model, and characterizing the relationship between the concentration of the studied impurities and the contact time of ameliorants with poultry wastewater Figure 3,4.

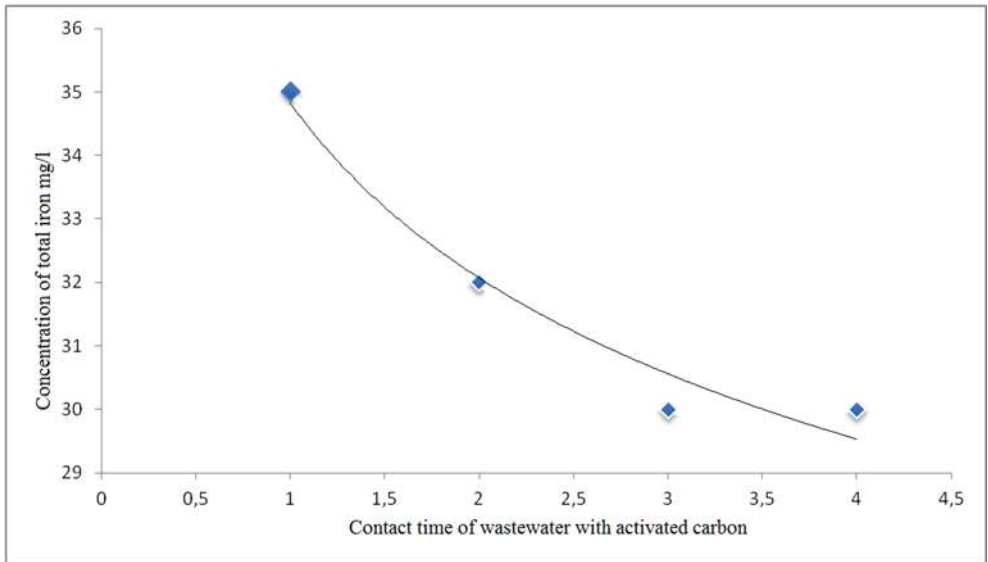


Fig. 3. Dependence plot of substance concentration and contact time of wastewater with activated carbon.

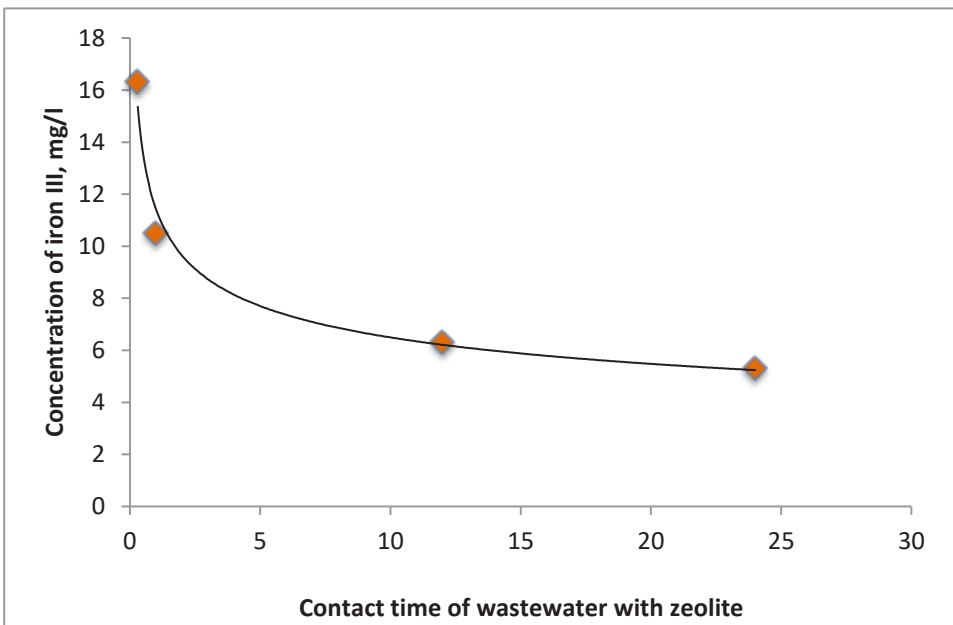


Fig. 4. Dependence plot of substance concentration and contact time of wastewater with zeolite.

Conducting an experimental study on the sorption properties in static conditions of ion-exchangers, we can see that the best result showed aluminosilicate (zeolite) than wood activated carbon.

4 Discussion

In the countries of the world there is an acute environmental problem associated with the pollution of water bodies, as well as agricultural land, containing heavy metals and ammonium ions. Due to the intensive development of industrial enterprises, livestock and

poultry complexes, there is a need for effective treatment of wastewater from these enterprises, as sometimes these wastewater do not pass any pretreatment at all.

In our opinion, the issue of wastewater treatment of heavy metals and ammonium ions would be solved by using sorption treatment, the use of cheap natural sorbents. In this regard, the possibility of using zeolite sorbent in poultry waste treatment systems from heavy metals and ammonium ions, as a sorption filtering load as a method of wastewater treatment of poultry enterprises, is an important scientific problem and is of great practical importance.

This technology can be suitable for all large poultry farms, as well as farms engaged in poultry.

5 Conclusion

The result of research in the study of heavy metal absorption properties showed that zeolite has the highest quality of wastewater treatment. Removal of ions of chemical elements was more than 60 percent within 12 hours of being in the liquid phase, unlike the wood activated charcoal.

Experimental data focuses on reducing the environmental load of water bodies in which wastewater is discharged. According to these results, we can see that the wastewater treatment process showed a decrease in the toxicity of chemical elements to the maximum allowable concentration, which corresponds to sanitary standards. Therefore, it is possible to discharge wastewater into water bodies and use it as irrigation water for irrigation of industrial crops.

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