

EFFLUENT MANAGEMENT ON UNSEWERED RURAL AREA

Summary

Domestic sewage management from unsewered rural areas in accordance with the requirements of environmental protection has become increasingly important in recent years. It is estimated that more than 500 hm³ of sewage are produced annually in rural areas, but only 20% of it are transported through the sewage network to sewage treatment plant. The aim of this study was to analyze the management of domestic sewage in unsewered rural areas. The study was conducted among 43 households. The research results show that more than a half of the raw sewage produced in rural areas goes directly to the environment.

Key words: domestic sewage, sewage management, unsewered areas

ZAGOSPODAROWANIE ŚCIEKÓW BYTOWYCH NA NIESKANALIZOWANYCH TERENACH WIEJSKICH

Streszczenie

Zagospodarowanie ścieków bytowych z nieskanalizowanych terenów wiejskich zgodnie z wymogami ochrony środowiska nabiera w ostatnich latach coraz większego znaczenia. Szacuje się, że na terenach wiejskich wytwarzane jest rocznie ponad 500 hm³ ścieków, z czego tylko 20% trafia siecią kanalizacyjną do oczyszczalni. Celem pracy była analiza zagospodarowania ścieków bytowych na nieskanalizowanych terenach wiejskich. Badania przeprowadzono wśród 43 gospodarstw domowych. Wyniki badań wskazują, że ponad połowa surowych ścieków wytworzonych na terenach wiejskich trafia bezpośrednio do środowiska.

Słowa kluczowe: ścieki bytowe, zagospodarowanie ścieków, tereny nieskanalizowane

1. Introduction

According to the data of communal infrastructure published by GUS (Central Statistical Office) only 68,7% of the population used the sewerage system in 2015, and about 906 hm³ of sewage were discharged from the households, and 88% of it were the sewage from urban areas. Taking into account the population from 2014 living in the cities (about 23,2 million) and in the villages (over 15,2 million), it can be estimated that the population living in the rural areas is able to produce about 524 hm³ of domestic sewage. From such amount of sewage only 106 hm³ were discharged through the sewage network [1, 2]. Domestic sewage in rural areas is mostly produced in households and public utilities. It contains dispersed organic and non-organic substances, such as: human and animal excrements, food waste, dissolved soap and other detergents, fragments of fabric, paper or sand and ash [8, 9]. In domestic sewage you can also find dangerous to health plant and animal micro-organisms, including bacteria, viruses and parasites [7]. The impurities that can be found in domestic sewage can be divided into: inorganic substances (chlorides, nitrates, phosphates, sulphates, carbonates etc.), solid matter (dissolved, falling, non-falling, organic and inorganic), organic matter (identified with such indications as BZT₅, ChZT, OWO), microorganisms (bacteria and protozoans) [8]. The problem of domestic sewage impact on the environment gained more importance in Polish non-urbanized areas in the early seventies of the 20th century. On one hand, the amount of sewage from individual households and habitats has increased considerably, on the other hand the sewage chemical composition changed at that time. The increase in the amount of discharged sewage was mainly due to the in-

crease of rural water mains and the development of tourism. Whereas the change in the chemical composition of the domestic sewage resulted from the widespread use of new washing powders, in which in order to soften water sodium phosphate was used instead of soap. The chemical composition of the sewage was also influenced by later widespread use of dishwashers and shampoos. At that time phosphates appeared in the rural domestic sewage [12]. In the recent years in Poland there has been a large increase in the number of installed domestic sewage treatment plants [4, 6]. Everywhere, where considering economic conditions it is not justified to build a collective sewerage and disposal system for domestic sewage it is recommended to install individual sewage treatment plants [3, 13]. Unfortunately, when choosing the system of sewage treatment, the investor usually limits himself to one selection criterion which is the price of the entire installation, and this may result in less efficient sewage treatment and cause higher operating costs [5]. Unfortunately, both the amount of sewage disposed of in the domestic sewage treatment plants and this which is discharged into the treatment plants is still significantly lower than the amount of domestic sewage produced in the rural areas. This may mean that significant amount of domestic sewage is disposed of in an uncontrolled way. According to the studies conducted on the treatment of other harmful substances in the rural areas, the significant part of the waste goes directly to the environment [10, 11].

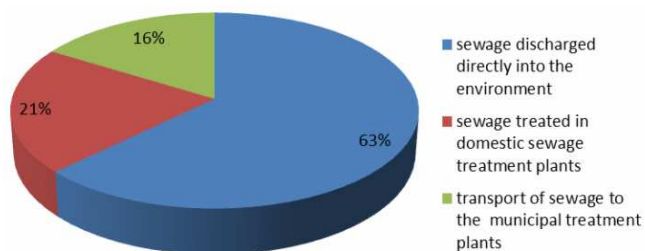
2. The purpose, the scope and the methodology of research

On the basis of literature review, that the majority of the domestic sewage produced in rural areas is managed locally because it does not go to the municipal sewage treatment

plants. Despite the increasing number of domestic sewage treatment plants, the significant amount of sewage must be managed in other ways. The aim of this paper was to analyze the state of domestic sewage management in rural areas without the sewage system, and as a result to determine the amount of domestic sewage which goes without the neutralization directly into the environment. The research was conducted implicitly using the dedicated questionnaire among 43 households located in 6 different localities in the Wielkopolska region (krotoszyński district). The questions included in the questionnaire were open and the choice of respondents was random. The respondents answered question directly related to the production of domestic sewage in their households, taking into account the number of people living there. The respondents defined the manner of storage and discharge of produced domestic sewage.

3. The results and the research analysis

The study was conducted in 43 households with the total number of 168 people. Thanks to the provided anonymity during the survey the respondents determined how they manage the produced domestic sewage. The research shows that the vast majority of the domestic sewage goes directly into the environment. Taking into account the number of people living in the analyzed households, the value is as much as 68%. Detailed information is given in Fig. 1.



Source: own work / Źródło: opracowanie własne

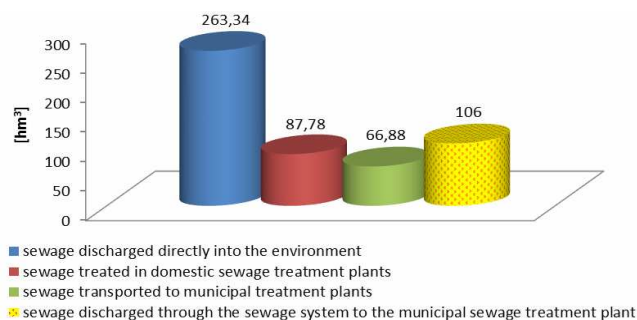
Fig. 1. Percentage distribution of domestic sewage management

Rys. 1. Procentowy udział sposobów zagospodarowania ścieków bytowych

The respondents have defined different ways of discharging of domestic sewage directly into the environment, but the most common are the following: discharging to watercourses, draining to the farming grounds in the form of organic fertilizer, spontaneous emptying of the leaky septic tank. Among the people who declare sewage treatment in domestic sewage treatment plants are also those, who understand that domestic sewage treatment plant means the discharge of sewage directly from the septic tank onto the permanent grassland. The problem is more disturbing since the animal feed is collected from the grassland. Among the people who declare the transport of sewage to the municipal sewage treatment plant are people who do it less than once every three years.

Based on the analysis, and based on the data provided by GUS (Central Statistical Office) [1] the amount of domestic sewage produced in rural areas, that was estimated, concerned the sewage that goes directly into the environment without treatment. As it is shown in Fig. 2, out of 524 hm³ of domestic sewage including 106 hm³ of sewage discharged through the sewage system directly to the municipi-

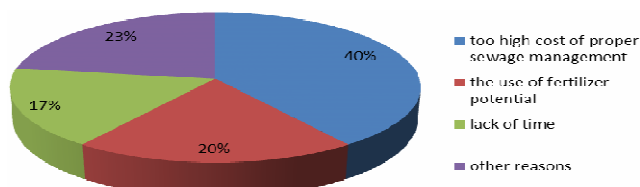
pal treatment plant, more than 263 hm³ go directly into the environment.



Source: own work / Źródło: opracowanie własne

Fig. 2. Amount distribution of domestic sewage management
Rys. 2. Rozkład ilości zagospodarowania ścieków bytowych

The respondents usually had a proper knowledge of the sewage management principles. Unfortunately, as the most often listed reason for actions in contradiction with environmental protection requirements, the respondents mentioned the financial aspects (Fig. 3). The construction of domestic sewage treatment plants often costs more than they can afford, and the transport of sewage to the sewage treatment plants also involves fees. Therefore it is very important to introduce proper methods of inactivation of domestic sewage, allowing for their agricultural use. The works on one of such methods are carried out at the Institute of Biosystems Engineering at Poznań University of Life Science [12], and the purpose of these works is to give the value of fertilizers to the domestic sewage, as a result it will contribute to the reduction in the amount of raw sewage that is discharged directly into the environment.



Source: own work / Źródło: opracowanie własne

Fig. 3. Percentage distribution of reasons for improper sewage management

Rys. 3. Procentowy udział powodów nieprawidłowego zagospodarowania ścieków

4. Conclusions

The conducted research and the analysis of the obtained results allow us to formulate the following conclusions.

1. More than 60% of raw sewage produced in rural areas go directly to the environment, which is not in line with current regulations in force.
2. Transformation of domestic sewage into a sanitary organic fertilizer will give to it a material value, which can contribute to an increase in demand for this raw material.
3. Financial aspects (40%) are the most common cause for the discharge of domestic sewage directly into the environment, therefore some measures should be taken to increase the financing of the domestic sewage treatment plants or other substitute technologies.

5. References

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