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WATER QUALITY MONITORING AT DISTRIBUTION AND DISCHARGE IN AREAS WITH ACTIVITIES OF AGRO-FOOD INTEREST

MONITORIZAREA CALITĂȚII APEI LA DISTRIBUȚIE ȘI DEFLUIRE ÎN ZONE CU ACTIVITĂȚI DE INTERES AGRO-ALIMENTAR

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ABSTRACT | REZUMAT

Clean water resources are limited by the continuous growth of public and technological consumption, which is largely generated by agro-industrial activities. This study is focused on the comparative analysis of the quality of potable water at distribution and wastewater at discharge in areas with a major impact on local agro-food production and processing. The research was carried out during the year 2021 in areas with commercial agro-industrial units representing six large areas and 13 small drinking water management areas. Based on the data reported by the County Directorate of Public Health, we analysed the quality of potable water distributed in these areas, by correlating six basic microbiological parameters. In parallel, we also evaluated the evolution of the wastewater quality at discharge within the local treatment plants analysing the test reports, developed by authorised laboratories in the field. The tests were carried out using standardised methods, and the obtained data were the basis for quantifying the degree of compliance and the effectiveness of the measures imposed by the authorities in the field. When we monitored the quality of potable water, we discovered that the majority of the tested samples were within the legal limits. In the areas of the Mureș basin administration, exceedances of these standards were recorded extremely rarely, and the share of non-compliant tests was very low (0.25%), due to exceedances in the cases of *E. coli*, coliform bacteria, and enterococci. Comparatively, in the large and small areas of the Covasna basin administration, more frequent exceedances of the allowed values were recorded, and the higher proportion of non-compliant tests (8.17%) was due to exceedances in all 5 evaluated microbiological parameters. We did not find evaluations of the microbiological parameters; the test reports referred only to a few physicochemical indices, of which residual chlorine at the end of the network, ammonium, and suspended matter were more frequent. We present arguments regarding the polluting action of agro-zootechnical and food industry activities on surface waters, as well as the need for microbiological testing of wastewater at discharge.

Keywords: water quality, treatment plants, discharge

Resursele de apă curată sunt limitate de creșterea continuă a consumului public și tehnologic, care este generată, în mare parte și de activitățile agroindustriale. Acest studiu este axat pe analiza comparativă a calității apei potabile la distribuție și apei reziduale la efluire în zone cu impact major în producția și procesarea agroalimentară locală. Cercetările au fost efectuate, în cursul anului 2021, în zone cu unități comerciale agroindustriale, reprezentând 6 zone mari și 13 zone mici de administrare a apei potabile. Pe baza datelor raportate de Direcția județeană de Sănătate Publică, am analizat calitatea apei potabile distribuite în aceste zone, prin corelarea a 6 parametri microbiologici de bază. În paralel, am apreciat și evoluția calității apei reziduale la efluire, după tratarea în stațiile locale, analizând rezultatele consemnate în buletinele de încercare, elaborate de laboratoare autorizate în domeniu. Testările au fost efectuate prin metode standardizate, iar datele obținute au stat la baza cuantificării gradului de conformitate și eficienței măsurilor impuse de autoritățile în domeniu. La monitorizarea calității apei potabile am relevat încadrarea majorității probelor evaluate în limitele admise de legislația actuală. În zonele administrației bazinale Mureș, depășirile acestor standarde au fost înregistrate extrem de rar, iar ponderea testelor neconforme a fost foarte scăzută (0,25 %), fiind dată de depășiri la *E. coli*, bacterii *coliforme* și *enterococci*. Comparativ, în zonele mari și mici ale administrației bazinale Covasna au fost înregistate depășiri mai frecvente ale valorilor admise, iar proporția mai crescută a testelor neconforme (8,17%) a fost dată de depășiri la toți cei 5 parametri microbiologici evaluați. La analiza apei reziduale efluente din stațiile de tratare, nu am găsit evaluări ale parametrilor microbiologici, buletinele de încercare făcând referiri doar la câtiva indici fizico-chimici, dintre care, depășiri frecvente au prezentat clorul rezidual la capăt de rețea, amoniul și materiile în suspensie, mai ales în cazul unor stații uzate. Această lucrare aduce argumente detaliate privind acțiunea poluantă a activităților agrozootehnice și de industrie alimentară asupra apelor de suprafață, precum și necesitatea testării microbiologice a apei reziduale la efluire.

Cuvinte-cheie: calitate, apă, stații de tratare, efluire

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Clean water is characterised by reaching certain standards with a major impact on human health, animals, and the environment in general, thus constituting a potential source of water for public consumption.

Potable water for urban agglomerations and some industries, such as food or pharmaceutical, is mainly provided by surface sources (usually rivers), which can be supplemented or replaced in some areas with deep sources (artesian wells) and in the countryside with certain springs or wells (12). All these sources are permanently subject to the risks of pollution, frequently generated by wastewater discharged from various treatment plants or discharged directly into surface waters without prior treatment. In this context, the contribution of Polytechnic universities (through the faculties of environmental engineering) to finding new solutions regarding the arrangement of water reserves, the treatment and recycling of wastewater, and the integrated approach of topographical projects and geographical information is particularly beneficial (16). Although, from a microbiological point of view, an extremely diverse microbial flora develops in water (bacteria, protozoa, fungi, algae, and even viruses), only a few bacterial strains are included in the quality standards and are frequently determined. Such microbes are commonly pathogenic agents, or conditional pathogens (opportunistic), frequently found in the aquatic environment and soil, and are able to trigger infections in humans and animals, under certain conditions (17, 23). Among the categories of wastewater with a high epidemiological risk for humans and animals, those of domestic origin abound, followed by those resulting from the agro-food industry (28). Although these risks are constantly increasing, most laboratory analyses regarding wastewater quality control are frequently limited to the evaluation of the main physicochemical parameters and less to the microbiological ones (9). According to research in the field of water quality analysis, the most relevant microbiological indicators are represented by microbial agents disseminated through human or animal feces, which represent the major source of water contamination. We also remind that such analyses have the advantage of identifying and quantifying microbiological indices through simple and cost-effective methods, and the obtained results are valid for a relatively short period (8, 11). When analysing water, a wide range of pathogenic and potentially pathogenic microorganisms can be determined, usually through quantitative tests that include several steps: pre-enrichment, selective enrichment, cultural isolation, identification through biochemical, serological, and/or molecular tests, and eventually, epidemiological typing. In the case of some pathogenic microbial strains of faecal origin that multiply actively in water (e.g., *Pseudomonas aeruginosa* and *Vibrio spp.*), it is necessary to resort to direct identification methods (15). On the other hand, the increase in environmental pollution has also significantly affected groundwater, which represents an important resource of clean water, and especially for irrigation in agriculture (2). On the other hand, the positive impact of floods on groundwater quality should be noted, which consists in reducing the salinity of underground water (8). Determining the flow and the intake of wastewater or other water that is being introduced into the sewerage network, can be done with a certain approximation based on the population equivalent coefficient (LE). These coefficients are established concerning the main wastewater standards (organic matter, suspended matter), using as a basic indicator the biochemical oxygen consumption per 5 days (CBO5), whose average value for household water was established at 54 g/inhabitant/day (8). It should also be noted that there are many modern technologies in which water consumption is very low but the concentration of organic substances remains high, with the perspective of using a treatment plant for at least 25 years (24). We also mention that, in many cities, the street sewage network also collects rainwater, creating a major problem regarding the assessment of the rainwater flow per square meter compared to the duration of time (14).

The present study aimed to analyse the quality of the potable water distributed in some areas of two basin administrations and of the discharged wastewater from the treatment plants in correlation with the polluting potential of the currently used agro-zootechnical and food industry technologies.

MATERIALS AND METHODS

The accomplishment of this study was based on documentation and correlative analysis that were carried out during 2021 following access to two sets of public data, regarding the monitoring and management of potable water and wastewater,respectively in areas of major agri-food interest for Mureș and Covasna counties.

In the first set, we grouped and processed a set of data regarding the monitoring and management of drinking water, taken from the annual public reports of the Public Health Directorate (DSP) of Mureș and the Public Health Directorate (DSP) of Covasna. Their analysis was mainly focused on the interpretation of the results of the microbiological tests within the annual drinking water quality monitoring programme. Initially, we grouped the accessed data by administrative areas in the two counties. Thus, from the Mureș Water Basin Administration (ABAM), we selected 3 large distribution areas, and from the Covasna Water Basin Administration (ABAC), 3 large areas and 13 small supply areas. All the chosen areas are rich in commercial companies of national interest with specific agro-zootechnic and agro-food sectors. The data recorded during the monitoring of the distributed drinking water to consumers within ABAM were grouped into 3 urban agglomerations extended to rural suburbs focused on the food industry, representing large areas of drinking water supply (ZAP M - M1, M2, and M3). In the organisation of ABAC data, the annual distributed volume of water represented the variable of their differentiation into large areas (ZAPM - C1, C2, and C3, with approximately 3,400,705 cubic metres of water/year) and small areas (ZAPm - 1-13, with approximately 1,419,944 cubic metres of water/year). The drinking water sources had the following origin in the case of ZAPM: 3 from the public network (M1, M2, and M3); 2 from underground water (C1 and C3, from 51 and 6 wells with a depth of 50 m, respectively); 1 from surface water (from 2 wells with a depth of 30 m). In 8 of the 13 ZAPm, the potable water was derived from underground sources (2-4 wells with a depth of 30-80 m), in 3 from collected springs, and in the last two, from wells plus collected springs and from surface water, respectively. The data published on the websites of DSP Mureș and DSP Covasna allowed the assessment of the main microbiological parameters' evolution that are monitored in the case of drinking water, such as *Escherichia coli (E. Coli*), Coliform bacteria, Enterococci, *Clostridium perfringens* (*Cl.perfringens*; +spores), bacterial colonies at 22°C, and bacterial colonies at 37°C. These parameters were determined by using standardised methods provided by the current legislation, with their values expressed in CFU/100 mL (CFU = colony-forming units) (9).

The second set of data has grouped the analysis of test reports regarding the quality control of wastewater discharged from some of the studied areas, after their treatment in local or own treatment plants. These analyses were carried out by public and private authorised laboratories, and their results are available to the general public. In this regard, we resorted to the processing of primary data taken from the analysis reports developed mainly by the county laboratories of the Water Management System (SGA), as well as several third-party (private) laboratories, all with competencies in the field. Since these test reports do not include microbiological testing, we resorted to the analysis of the values recorded in the evaluation of some physicochemical parameters, represented inconstantly by pH; chemical oxygen consumption (CCO-Cr; mgO2/mL); biochemical oxygen consumption at 5 days (COB5; mgO2/mL); substances extractable with organic solvents (S.E. with Solv. Org.; mg/mL); anionic surfactants (detergents) (A.S.A.-Deterg.; mg/mL); total nitrogen (mgN/mL); ammoniacal nitrogen (mg/mL); suspended matter (MS; mg/mL); chlorides (mg/mL); filterable residue at 105 °C. We also remind that the households and agro-zootechnical micro-farms served by these treatment plants are insufficiently supported and monitored regarding the pollution level of surface waters and the environment in general. We also note that some of the wastewater treatment plants had technical problems during the period under study, which required the application of legal remedial action.

In carrying out the tests and developing the analysis (test) reports, the mentioned laboratories used standardised methods provided by the current legislation, facilitating the interpretation of the results by specifying the allowed values and the quantification limit for the used methods (LOQ). In this regard, we highlight that water can be considered potable if it meets the requirements outlined in the drinking water quality standards, defined by the European Drinking Water Directive; in Romania, these requirements are also set out in Law No. 458/2002, amended and supplemented by Law No. 311/2004. In the case of each parameter, we evaluated the number of tests performed and their results, differentiating them into conforming and non-conforming. In the end, we conducted correlative analyses regarding the efficiency of quality monitoring of potable water at distribution and of wastewater at discharge from treatment plants based on the quantification and interpretation of compliance and non-compliance percentages, respectively, in correlation with the duration of water interruption (days/number of hours) and the efficiency of the measures that have been applied by the authorities in the field.

RESULTS AND DISCUSSIONS

Quality analysis of distributed potable water at distribution

The values recorded during the quality monitoring of distributed potable water in different supply areas of ABA Mureș and ABA Covasna, as well as the degree of compliance and non-compliance, are presented in Tables 1 and 2. According to the analysis of the individual and average values obtained in 3 of the large areas of Mureș ABA, most of the tested drinking water samples fell within the standards provided by the current legislation (26, 27). In this regard, we only mention that the proportion of compliance tests reached 99.7%, and non -compliance was only 0.25% (Table 1).Slight deviations were reported, which constantly affected 3 of the 6 investigated microbiological parameters, indicating exceedances in 3 tests for *E. coli*, 5 for coliform bacteria, and 3 for Enterococci. The overall analysis of these microbiological tests, with only 11 (0.25%) non-compliant samples (recorded in 2 of the 3 monitored areas) from a total of 4309, reveals the assurance of a good level of drinking water quality from the public distribution network of ABA Mureș.

We remind that the exceedance of the allowed limits for microbiological parameters was not important in terms of values and number of samples, totaling 11 positive samples (0.25%), 5 in the M2 area and 6 in the M3 area. In this context, we attribute major relevance to the general degree of compliance, which reached 99.75%. Regarding the interruption of drinking water administration, as a legal measure to remedy such situations, we noted that the problems generated by the

Table 1

The values and degrees of compliance regarding the microbiological parameters of the distributed potable water in three large supply areas of ABA Mureș (M1-M3) (21)

Parameter	Tests (No.)			Non-compliant tests (No.)			Water cessation (No. days/hours)		
	M1	M2	M3	M1	M2	M3	M1	M2	M3
E. coli (CFU/100mL)*	186	431	374	-	1	2	-	1/7	1/2
Coliform bacteria (CFU/100mL)*	147	241	331	-	2	3	-	2/4	1/3
Enterococi (CFU/100mL)*	186	431	374	-	2	1	-	2/4	1/1
Cl. perfringens (+ spores) (CFU/100 mL)*	85	241	70	-	-	-	-	-	-
Colonies at 22 C° (CFU/mL)*	132	239	326	-	-	-	-	-	-
Colonies at 37 C° (CFU/mL)*	132	239	326	-	-	-	-	-	-
Tests/area (No.)	868	1.822	1.801	-	5	6	-	5/15	3/6
Total tests (No.)	4.309			11			8/75		
Compliance (%)	99.75			0.25			-		

* Allowed values - 0 (according to Law 458/2002 on the quality of potable water, republished in 2017 - HG 342 /2013); Cl-*Clostridium*; CFU-colony forming unit

exceeding of the microbiological standards were promptly resolved. Water supply interruptions were of short duration (1–7 hours), 48 in number, with a total duration of 38 hours.

Satisfactory results were also revealed by the recorded values in the case of the 13 monitored areas within ABA Covasna. These results were also within the limits for most of the investigated tests, with exceedances for all monitored microbiological parameters. The overall analysis of the quality of the potable water that is distributed in these areas of great agro-industrial interest confirmed the decrease in the average values of the compliance level (91.82%), compared to the areas in ABA Mureș (99.7%), implicitly correlated with a higher proportion of non-compliant tests (8.17%). In addition, we obtained interesting results when approaching the variables introduced in the study of the ABA Covasna areas. They succinctly reveal the impact of the main microbiological parameters, administration area, and water source, on the distributed water quality, by quantifying the relevance of compliance levels. Thus, regarding the 3 ZAPM that were investigated, the following distribution of the proportions of non-compliant tests for the main assessed microbiological parameters has been observed: 1.53% for coliform bacteria, 1.89% for colonies at 22°C and colonies at 37°C, respectively, the lack of positive tests for *E. coli* and enterococci. In contrast, in the case of ZAPm, non-compliant tests were recorded for all 5 microbiological parameters (Table 2), with values of 8.04% for *E. coli*, 14.4% for coliform bacteria, 3.58% for enterococci, and 18.04% for each of the last two parameters (colonies at 22°C, respectively colonies at 37°C). We also found certain influences from the source used in the distribution of drinking water in the monitored areas. Thus, in the case of surface water, non-compliant tests were revealed only for colonies at 22°C (0.77%) and colonies at 37°C (0.77%). While, in the case of underground water sources, several positive tests were recorded, which included coliform bacteria (1.4–3.3%), along with colonies at 22°C (0.77–3.3%), and colonies at 37°C (0.77–3.3 %). Regarding the interpretation of the extremely variable percentages of the non-compliant tests that were recorded when monitoring the quality of the water sources used in these areas, we only mention that such an analysis requires extensive investigations, which allow relevant statistical calculations. We can observe, however, the important differences between the general share of non-compliant tests, which represented 13.93% for ZAPm and only 1.81% for ZAPM. This fact underlines that the water sources used in small areas were more microbiologically contaminated than those used in large areas.

Quality analysis of the discharged wastewater from the treatment plants

The centralization and processing of public data related to the efficiency of treatment plants and the quality of discharged wastewater are summarised in Table 3. We mention first of all that, both in the public reports and test reports, we did not find data related to the monitoring of microbiological parameters in the case of treated wastewater. In correlation with the reported data in the field, we resorted to the summary analysis of the test reports, which were offered by 7 agro-industrial commercial companies (3 agro-zootechnical cooperatives and 4 dairy processing companies) equipped with their wastewater treatment plants. In this regard, we only present the overall results obtained when processing the recorded data during the periodic self-control evaluations of the investigated wastewater treatment

Table 2

Values and degrees of compliance regarding the microbiological parameters of potable water distributed in large (ZAPM) and small (ZAPm) areas of ABA Covasna (22)

Area/ Water source	Parameter									
	*E. coli** (CFU/100mL)		Coliform bacteria* (CFU/100mL)		Enterococi* (CFU/100mL)		Colonies at 22°C* (CFU/mL)		Colnies at 37°C * (CFU/mL)	
	T (No.)	T-Nc (No./%)	T (No.)	T-Nc (No./%)	T (No.)	T-Nc (No./%)	T (No.)	T-Nc (No./%)	T (No.)	T-Nc (No./%)
ZAPM 1/Surf.	-	-	214	3/1.4	-	-	212	7/3.3	212	7/3.3
ZAPM 2/ Surf.	-	-	-	-	-	-	258	2/0.77	258	2/0.77
ZAPM 3/ Surf.	-	-	111	2/1.80	-	-	111	2/1.80	111	2/1.80
Total	-	-	325	5/1.53	-	-	581	11/1.89	581	11/1.89
C/NC (/%)	-		98.46/1.53		-		98.10/1.89		98.10/1.89	
£ C/NC (No.%)	**1.487/27; 98.18/1.81**									
ZAPm 1/Subterr.	-	-	54	5/9.25	-	-	54	6/11.11	54	6/11.11
ZAPm 2/ Well	4	1/25	4	1/25	4	1/25	4	1/25	4	1/25
ZAPm 3/Spring	2	2/100	2	2/100	-	-	2	2/100	2	2/100
ZAPm 4/Spring	1	1/100	1	1/100	-	-	1	1/100	1	1/100
ZAPm 5/ Subterr.	-	-	59	4/6.77	-	-	59	8/13.5	59	8/13.5
ZAPm 6/ Subterr.	48	1/2.08	48	12/25	48	1/2.03	48	15/31.2	48	15/31.2
ZAPm 7/ Subterr.	-	-	57	1/1.75	-	-	57	5/31.2	57	5/31.2
ZAPm 8/ Subterr.	-	-	3	2/66.66	-	-	3	3/100	3	3/100
ZAPm 9/ Subterr.	113	3/ 2.65	113	20/17.6	113	1/0.88	113	29/25.6	113	29/25.6
ZAPm 10/ Subterr	-	-	-	-	108	1/0.92	108	5/25.6	108	6/25.6
ZAPm 11/ Subterr	3	3/100	3	3/100	3	3/100	3	3/100	3	3/100
ZAPm 12/Spring	1	1/100	1	1/100	1	1/100	1	1/100	1	1/100
ZAPm 13/ Surf.	2	2/100	2	2/100	2	2/100	2	2/100	2	2/100
Total	174	14/8.04	290	42/14.48	279	10/3.58	445	81/18.04	455	82/18.02
C/NC (%)	91.95/8.04		85.51/14.48		96.41/3.58		81.95/18.04		81.97/18.02	
£ C/NC (No.%)	**1.643/ 229; 86.06/ 13.93**									
ZAPM + ZAPm (no=16) - £ C/NC (No.;%)	**3.130/ 256; 91.82/8.17**									

*Allowed values - 0 (according to Law 458/2002 on the quality of potable water, republished - HG 342/2013); Cl-*Clostridium*; CFU – colony forming unit; Surf. - surface; Subterr.-subterranean; C-compliant; NC – non-compliant; £ - amount

plants. Thus, according to the data mentioned in Table 3, the tested parameters fell within the legal standards for the quality of wastewater, but only in a small part. They indicated important deviations for most of the monitored parameters, respectively, for most of the investigated treatment plants. The analysis of the values of each parameter separately, respectively, at each station resulted in exceeding the allowed values for 6 of the 10 tested parameters. As shown in Table 3, the distribution of the non-compliant tests (data exceeding the allowed values/determined parameters) presented the following descending order: biochemical oxygen consumption at 5 days - 5 non-compliant tests; suspended matter - 5 non-compliant tests; substances extractable with organic solvents - 3 non-compliant tests; chemical oxygen consumption determined by the bichromate method - 2 non-compliant tests; total nitrogen - 2 non-compliant tests. We also mention that, in the case of some parameters, such as ammoniacal nitrogen, chlorides, filterable residue at 105°C, pH, and anionic sur-

Table 3

The values of the main parameters determined during the self-control of the discharged wastewater quality from the treatment plants owned by some agricultural cooperatives or commercial milk processing companies

Parameter	UM	Allowed values	Wastewater treatment plants							Nc. Tests
			S1	S2	S3	S4	S5	S6	S7	
pH	(U. pH)	6.5-8,5	4.8	7.6	7.7	7.14	7.28	7.7	7.91	-
CCO-Cr	(mgO_2/L)	125-500	1115	344	382	480	389	820	50	2
CBO5	(mgO_2/L)	25,0	-	197	290	179.0	120	353	< 3	5
E. S. with Org. Solv	(mg/L)	20	-	-	-	24.2	25.2	208	< 2	3
A.S.A. (Detergents)	(mg/L)	25.0	0.198	0.42	0.176	-	-	0.104	-	-
Total nitrogen	(mg N/L)	10 (15)	1.079	29.6	29.2	-	-	5.50	0.35	2
Ammoniacal nitrogen	(mg/L)	25 (37)	1.389	-	-	-	-	-	-	-
Chlorides	(mg/L)	500	-	36.3	46.3	-	-	30.6	-	-
Suspended matter	(mg/L)	35 (60)	-	180	148	188	101	683	6	5
Filtrable residue at 105^{0}C	(mg/L)	2000	-	646	585	-	-	285	2290	1
Nc. tests	(No.)		1	3	3	3	3	4	1	18

E. S. with. Org. Solv. – extractable substances with organic solvents; A. S. A. (Detergents.) – Anionic surface agents (detergents); CCO-Cr – chemical oxygen consumption; COB5 – biochemical oxygen consumption at 5 hours; S1 – Agricultural cooperative station; S2 -S.C. Dairy products station; S3 –S.C. Dairy products station; S4 –Agricultural cooperative station; S5 -S.C. Dairy products station; S6 –Agricultural cooperative station; S7 –S.C. Dairy products station; Nc. –Non-compliant

face agents (detergents), no non-compliant tests were recorded. The correlation between the efficiency of the treatment plants and the technological processes from which the wastewater originates reveals that in the case of mixed agricultural cooperatives, the treatment plants were less efficient, registering between 1 and 4 non-compliance tests,compared to the milk processing companies, which presented between 1 and 3 exceedings of the allowed values for the tested parameters.

Regarding the monitoring of the microbiological parameters of the discharged wastewater from the treatment plants, we have noted that such tests were not identified in the test reports issued for the studied agricultural cooperatives and commercial milk processing companies. However, we have found such results sporadically after further examination of 14 other assessment reports of wastewater treatment plants in agro-industrial technological flows. They recorded very low percentages of non-compliance (below 1%) that were observed in the case of two microbiological tests, which evaluated the total microbiological flora. In this context, we consider it opportune to extend the microbiological testing to the technological wastewater in agro-industrial processes, after its discharge from the treatment plants. In the agricultural, food, and fertiliser industries, many polluting sources contribute, along with those from other industrial branches, to the dissemination of numerous nutrients (29). Thus, various zootechnical and agrotechnical activities (storage and use of organic and chemical fertilisers) can lead to the diffuse pollution of water resources through various ways of spreading the pollutants, frequently surface leaks, atmospheric deposition, and soil erosion (29, 1, 12). The application of European legislation determined the implementation throughout Romania of some key measures to reduce nutrient emissions, correlated with agricultural practises to reduce diffuse pollution. In this context, the measures implemented by Council Directive 91/676/EEC/1991 and Law No. 458/2002, amended and supplemented by Law No. 311/2004, are included.

The main sources of water pollution in particular and the environment in general continue to represent a very topical problem with a major impact on the fu-ture of natural areas and urban and suburban agglo-merations (6, 8, 15). Currently, huge amounts of inor-ganic and organic pollutants accumulate, making them extremely dangerous for water and the environment. This fact is largely due to the continuous growth of un-controlled chemicalization, intensification, and automa-tization in the agriculture and food industries (3, 4). To all this is added the increase in the share of the urban population and the intensification of transport, indus-trial, and energy activities, the expansion and technolo-gical diversification in general, and the multiplication of accidents generated by nuclear reactors or nuclear waste storage facilities. When the concentration of pollutants exceeds certain limits and their presence seriously endangers the environment, human and animal health, remedial actions are required (10, 13). Remedial measures are mainly based on the extraction of pollutants from soils or aqueous systems or their reduction through mobilisation and/or stabilisation *in situ*, respectively, through wastewater treatment (3, 25).

In the prevention and reduction of pollution, which has become a problem of global interest, a set of services coordinated and supported by various public or private institutions and authorities with competencies in the field. In this regard, we only mention that the Directorate of Public Health deals exclusively with the physicochemical and microbiological monitoring of the sanitary quality of water, which is used in all sectors, including agriculture and food, and is the authority that confirms whether a source of water is potable or not. On the other hand, the Sanitary Veterinary and Food Safety Directorate (under the coordination of the National Sanitary Veterinary and Food Safety Authority - NSVFSA) monitors the quality of water used in agro-zootechnical farms and food industry units, mainly analysing compliance with microbiological and physicochemical standards. To ensure the safety of food, NSVFSA monitors the microbiological parameters of the water used for sanitation and, the physico-chemical parameters of the water used as an ingredient in food. The frequency of sampling and analysis depends on the water source, whether it comes from the public network or private sources. Also worth noting are the responsibilities recently assumed by APIA (Agency for Payments and Intervention in Agriculture) for reducing the polluting effects of households and agro-zootechnical farms on surface waters and the environment in general, which verifies and supports the arrangement of garbage platforms to neutralize it, as well as other practices necessary to protect the environment and implicitly water.

Among the major sources of water pollution in the studied areas are agro-zootechnical and food industry activities, which can be summarised as: the discharge of insufficiently treated wastewater due to the existence of some treatment plants that are too old; historical pollution, generated by certain commercial companies in the field; discharges of insufficiently treated wastewater, originating from agro-zootechnical works carried out in some farms or complexes; wastewater discharges from chemical fertilization works, insufficiently treated. Overall, the impact of these sources of pollution is exerted mainly on surface waters. The water used in domestic, industrial, or agri-food processes must be treated in sewage treatment plants because, after discharge, it cannot be recovered by conventional processes, except by modern electrochemical purification techniques (18, 19, 20).

CONCLUSIONS

The analysis of the microbiological quality of the drinking water for distribution in several areas of agrofood interest by two basin administrations showed that the majority of the evaluated samples were within the limits allowed by the current legislation. Exceedances of the legal standards were recorded extremely rarely in two out of three large areas of the Mureș basin administration, which gave a very low weight (0.25%) to noncompliant tests, found *for E. coli*, coliform bacteria, and enterococci. Comparatively, in a sample of 16 large and small areas of the Covasna basin administration, several exceedances of the allowed values were recorded, which gave a higher weight (8.17%) to the non-compliant tests found for all evaluated microbiological parameters (*E. coli*, coliform bacteria and enterococci, colonies at 22°C and colonies at 37°C). The correlation of the non-compliant tests' evolution with the area and source of potable water variables, revealed a higher degree of microbiological contamination of the water sources used in small areas than those used in large areas. During the analysis of the wastewater discharged from the treatment plants, we did not find evaluations of the microbiological parameters; the test reports included references only to a few physicochemical indices, of which residual chlorine at the end of the network, ammonium, and suspended matter, showed frequent exceedances, especially in the case of old treatment plants. Through this research, we argue in detail about the increase in the polluting action of agro-zootechnical and food industry activities on surface waters, as well as the need for microbiological testing of discharged wastewater.

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