

Estimation data on the faecal pollution of Arieş River

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Abstract. Faecal pollution of river water can lead to health problems because of the presence of infectious micro-organisms. These may be derived from human sewage or animal sources. Water safety or quality is best described by a combination of sanitary inspection and microbial water quality assessment. This approach provides data on possible sources of pollution in Arieş River water, as well as numerical information on the actual level of faecal pollution.

Keywords: river, water, faecal pollution, hygienic bacteria.

Résumé. La pollution fécale de l'eau peut entraîner de graves problèmes de santé en raison des micro-organismes pathogènes présent dans l'eau. Ces organismes pathogènes présents dans les matières fécales humaines et animales homéothermes peuvent arriver dans l'eau des rivières suite aux rejets d'eaux ménagères usées ou aux activités domestiques. Les réglages de la qualité de l'eau peut être obtenu à la suite de la révision de l'évaluation de la santé et de la charge microbienne de ces eaux. L'étude présente vise à fournir des informations sur les sources possibles de pollution fécale de l'eau de la rivière Arieş, respectivement, des informations sur le nombre approximatif de germes d'hygiène présents dans ces eaux.

Mots clés: rivière, pollution fécale, bactéries d'hygiène, qualité de l'eau.

Rezumat. Poluarea fecaligenă a apei poate să conducă la serioase probleme de sănătate datorită prezenței în ape a microorganismelor patogene. Aceste microorganisme patogene prezente în materiile fecale ale omului și animalelor homeoterme pot ajunge în apa râurilor ca urmare a deversărilor de ape fecaloide-menajere sau a activităților gospodărești. Stabilirea calității unei ape poate fi realizată ca urmare a analizei sanitare și a aprecierii încărcăturii microbiene ale acestor ape. Studiul de față oferă informații despre posibilele surse de poluare fecaligenă a apei râului Arieş, respectiv, informații asupra numărului probabil de bacterii igienico-sanitare prezente în aceste ape.

Cuvinte cheie: râu, apă, poluare cu fecale, bacterii igienico-sanitare.

Introduction. Rivers represent easy polluted media because at this level are discharged waters resulted by house-holding activity and diverse waste waters from industry, agriculture, pesticides, inorganic fertilizers, which all may contain infectious agents (Berkesy et al 2008; Coşier & Petrescu-Mag 2008; Proorocu et al 2008). Any small quantitative or qualitative modification in a microbial population allows establish the ecological state of an aquatic media and the identification of a possible source of pollution. The majority of illnesses transmittable by water have like etiologic agents the micro-organisms eliminated from the digestive tract (Mănescu 1989).

Detailed knowledge of the extent of faecal pollution in aquatic environment is crucial for watershed management activities in order to maintain safe waters for recreational and economic purposes (Maloş et al 2008). Techniques which enable rapid and sensitive detection of faecal pollution in environmental freshwaters are thus prerequisite for efficient water quality monitoring.

The sanitary quality of the water is appreciated on the presence or on the absence of pathogen micro-organisms or those values which indicate the possibility of their presence. To establish the faecal pollution of the Arieş River there were analysed the next

bacteriological parameters: the number of total coliforms (TC), faecal coliforms (FC) and faecal enterococi (FE).

The bacteriological parameters at the sediments level have a constancy and higher stability, being less influenced by some modifications produced in the media, and as a consequence, these reflect the waters quality evolution in time. From this point of view these indicators may serve as criteria of appreciation and prognosis of water quality evolution, but in the same way they may represent a decisive factor inside of the redressing measures in aquatic ecosystems (Cuşa 1996).

The aim of our study was determination in the Arieş River water of the hygienic bacteria which indicate the faecal pollution degree of this water. There were studied three groups of indicator bacteria: TC, FC and FE.

Material and Methods. To establish the faecal pollution of the Arieş River water, the water samples were taken seasonally (in January, April, July and October). There were established ten sampling points, upstream and downstream of the main towns that the river passes through (Abrud, Baia de Arieş, Sălciua, Turda and Luncani) and taking into consideration the main pollutant sources in the area. The water samples that will serve for the determination of the hygienic bacteriological state of the Arieş River was been taken from the river bed at 1 m from shore in sterile glass recipients.

To establish the nature of faecal pollution of Arieş River water it is used an indicator which represents a rapport between the faecal coliforms (FC) and the faecal enterococi (FE) germs. A higher value than 4 ($FC/FE > 4$) show a human source of pollution. When this rapport is between 2 and 4 ($2 < FC/FE < 4$), there is a mixed source of pollution, but dominate the human source and when this rapport it is between 0.7 and 1 ($0.7 < FC/FE < 1$) there is a mixed pollution but predominantly animal. The domestic animal waste pollution is characterized by a lower value than 0.7 ($FC/FE < 0.7$) (Barbato et al 1990; Cuşa 1996).

Due to their resistance to physical, chemical and biological agents, both FE and the FC have a sanitary importance as indicators of water faecal pollution. Moreover, this indicator amplifies the faecal pollution detection method and makes it more easy to use for two indicators instead of one.

According to our results, obtained by application of the rapport between the most probable number of FC and FE (PNFC/PNFE), presented in Table 1, we may establish the nature of faecal pollution of Arieş River water during the year 2008.

Table 1

Estimation data about Arieş River faecal pollution during 2008

Sampling point	2008			
	FC/FE January	FC/FE April	FC/FE July	FC/FE October
Abrud upstream	1.2	1.17	1.26	1.21
Abrud downstream	-	-	3.55	-
Baia de Arieş upstream	2	-	1.25	1.35
Baia de Arieş downstream	2	1.55	1.25	1.35
Sălciua upstream	-	-	3.9	-
Sălciua downstream	0.75	0.82	0.53	0.5
Turda upstream	0.31	4	1.978	2.8
Turda downstream	1.96	2.05	2.363	2.02
Luncani upstream	11.81	13.24	12.72	11.82
Luncani downstream	0.72	17.77	16.92	19

According to this rapport, in P1 sampling point (Abrud upstream) there is a mixed faecal pollution, but predominate the animal source for each of sampling period.

In Abrud downstream sampling point, in the winter, there were no faecal pollution detected, but in the summer there was detected the presence of a mixed faecal pollution, predominantly of human waste origin.

In Baia de Arieş upstream sampling point the faecal pollution of water was detected in each sampling season with values that exceeded 1 and which corresponded to a mixed faecal pollution but predominantly of animal origin, most probable due to grazing which is practiced on the river shore in the summer. At this sampling point level in the cold seasons the faecal pollution became predominantly of human origin.

A similar situation was observed in Baia de Arieş sampling point, but with the specification that at the level of this section the faecal pollution of river water was present in each sampling season.

In Sălciua upstream the water faecal pollution was detected only in summer, when the number of hygienic bacteria grows as a result of higher temperature of the water which has an increasing effect on the micro-organisms, and in this case the faecal pollution proved to be mixed but predominantly of human source.

In Sălciua downstream the faecal pollution of water was relieved in each sampling season. According to rapport analysis, results that in winter and in spring there is a mixed pollution, but predominantly with animal wastes, in summer and autumn the rapport values are < 0.7 which indicate the presence of the animal waste in the river water resulted from animal husbandry in this area.

In Turda upstream in winter was observed the presence of a faecal animal pollution with waste resulted from house holding activity. In this section along of the right shore of the river there are many villages, while on the left shore the river receive as affluent the Hăşdate. The left shore of the river is used for grazing in the summer meanwhile the right shore it is used as a recreational area. All those kind of activity is relieved by the predominantly human source of pollution in the summer, while in the cold season there is a mixed faecal pollution but predominantly of animal origin, probably due by the overflowing on the river shore of the animal wastes by the nearby village population.

In Turda downstream sampling point in each of sampling seasons there was relieved the faecal pollution of the river water with mixed wastes, but predominantly of human origin as a result of the municipal sewage discharges. Here can be already determined the powerful effect of the anthropic influence and in the same time the inadequate activity of the cleaning station.

In the P9 sampling point (Luncani upstream) was demonstrated the existence of a strong human origin source of faecal pollution in each sampling period. As well was in the next sampling point P10 (Luncani downstream) excepting the winter when the rapport PNFC/PNFE was 0.72 revealing a mixed pollution, but predominantly of animal origin.

Comparing our results with those from the literature (see Hamar et al 1995; Ştef et al 2005; Filimon & Drăgan 2007) we may affirm that, regarding the faecal pollution, Arieş River water is highly contaminated with human wastes especially in downstream of the river where it is strongly relieved the effect of urbanization. Our results demonstrate once again the necessity of a high depuration of faecal and residual sewage waters that are overflowed in the Arieş River, fact that was evidenced by the presence of pathogenic germs, especially by the high number of detected coliform germs.

Conclusions. In each analyzed water sample has been detected the presence of faecal pollution indicators (total coliforms, faecal coliforms and faecal enetrococi). Each studied group has shown seasonal fluctuations and numerical fluctuations according to the sampling points. The values of this indicators rises in from winter to autumn, usually the highest values are characteristic to the summer when the higher water temperature increase the development of micro-organisms and their activity.

The PNFC/PNFE rapport indicates the presence of faecal pollution of the Arieş River in majority of the sampling points. The faecal pollution of the water with animal waste was detected in the case of the sampling points situated upstream of the river (Abrud,

Baia de Arieş), Salciua downstream and Turda upstream where the river traverses rural areas.

The hygienic bacteriological indicator values are higher in the case of the sampling points that are situated in downstream of the river course where can be noticed the presence of a highly faecal contaminated water especially with human origin wastes due to the anthropic influence and the effect of urbanization. Laboratory studies results demonstrate once again the necessity of a high efficiency depuration of waste waters which are overflowed in Arieş River.

According to our study the Arieş River water has been classified using the values of bacteriological indicators suggested by Fodré & Lévai (1997), in the II class of sanitary health quality (easy polluted water) in the majority of sampling points, and in the III class of quality (polluted water) only in some sections where was relieved the presence of some major source of faecal pollution especially with human origin wastes.

There was noticed an accentuated variation of the faecal pollution level depending by the sampling season and by the studied bacteriological parameters.

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