CHEMICAL AND BIOLOGICAL CHARACTERIZATION OF SURFACE WATERS FROM GORJ DISTRICT

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The water represents a regeneration natural source, vulnerable and limited, essential element for life, determinant factor in maintaining the ecological equilibrium. The drainage of a water course is made from a ramification of affluent values directly or indirectly to the water flow, considered the main element of drainage. The valleys collect the part of precipitation and aquatic plants, which are transmitted to the main water flow. The hydrographical reservoir, of reception of collector of drainage represents the territory surface from which the waters resulted from the precipitations and the underground waters gravitate and penetrate in the drainage ramification. In the drainage area take place all physical processes which determines the hydrological drainages. The hydrographical reservoir conditions the river life. All elements of rivers drainage depend on its characteristics. The hydrographical reservoir is limited by the watershed defined as the line of the eminences from which the superficial drainage lead to the evacuation drainage. Due to the general modelation of relief by the exogenous factors, but especially for the rivers regressive erosion the watersheds represents a mobile element in time. The writing presents general aspects regarding the drainage of Gorj district; the climatic characteristics and pollution sources of main rivers. To evaluate the quality of surface waters samples were cropped from rivers like: Sadu, Balteni, Racari, Amaradia, Hurezani, Negoiesti, Albesti and the saprobiological index, dissolved oxygen, biochemical consume of oxygen , the suspensions, the chlorides and constant residuum were determined. After the accomplished determinations it was established that the value of saprobiological index for district rivers is of 2.3 fact which indicates a satisfactory ecological state (β-mezosa sample), the content of dissolved oxygen which has bigger values than the limit of the second class for the analyzed rivers, the evolution of suspension indicator attained the biggest value in 1999, the evolution of chloride indicator and of constant residuum with the biggest value in 1997.

Keywords*: water, pollution, evolution, indicators, limit, residuum, chlorides, suspensions.*

The drainage of Jiu River, which is afferent to Gorj district, is rich. The majority of affluents are confluents in Rovinari area downstream on the right: Susita, Jalesul, Bistrita,Tismana and on the left side Amaradia with its affluents Zlasti and Cioiana, Gilort River with its main affluent Galbenu.

On the large surface from Jiu waterside, from the reservoir of the Jilt River or from the superior reservoir of Amaradia (Seciuri zone) the exploitation of the brown cool through careers or underground, produced big perturbations in the drainage of phreatic waters also for depth waters. [1]

The wastes of sterile or ash deposits from the thermo (electric) power station created pressures over the existing phreatic stratifications or they have generated supplementary infiltrations in the phreatic area (Turceni zone). At the moment in Gorj district there are approximately 47163 of fountains in personal farms in the highway system.

The majority of these fountains in the long drought-stricken periods restore their resources in the rainy periods.

From the existing projects from Gorj district concerning the alimentation with drinking water through drilling (drilled well) in the fallowing years will be observed: Danesti (14 drillings/49 l/s) , Balesti (4 drillings/12 l/s), Arcani (2 drillings/14 l/s), Telesti (1 drilling/8 l/s), Calnic (2 drillings/8 l/s), Turburea (3 drillings/11 l/s), Glogova (1 drilling/8.5 l/s). For smaller cities, the underground alimentation in the fallowing years foresee: 23 drillings for Motru, 13 drillings for Rovinari (over 1000 l/s), 8 drillings for Tg-Carbunesti (40 l/s).

For the valley of Amaradia River three zones imported with depth waters are observed: Stoina – Cruset area with aquatic stratification at 100 – 200 m depth and total resources of 34 l/s, Hurezani area with aquatic stratifications at 150 m depth and total resources of 65 l/s and Logresti area with aquatic stratifications at 100 m depth and total resources of 33 l/s. For Gilort waterside is underlined as aquatic depth potential the area Tg-Carbunesti – Albeni with total deposits over 100 l/s situated at 350m depth; there are also noticed Turburea and Tantareni areas with no development at the moment.

For the waterside and Jiu terraces, Tg-Jiu, Iezureni-Curtisoara-Rovinari (the left shore of Jiu), Balteni and Turceni with there aquatic reserves are detached.

Even though they are found at depth of 800-1000m, regarding their exploitation potential (525 l/s) presents importance in the perspective waterside and mountain area from Balesti and Calnic. At the moment there can be found at the exploitation level depth drilling which feed (in drought-stricken periods) the Tg-Jiu city 120 l/s by the 17 drillings from Iezureni-Curtisoara), Ticleni City (1 drilling with 15 l/s), Rovinari and Tg-Carbunesti.

In *table 1* dates regarding Jiu, Cerna and Oltet reservoirs for Gorj district are presented.

Table 1

The length surface of Gorj reservoirs

The Reservoir	The Length of Main Water Flow in the District (km)	The Length of Main Water Flow codified in the District (km)	The Reservoir Surface in the District (km)
Jiu	**139**	**2002**	**5577**
Cerna	**15**	**93**	**133**
Oltet	**41**	**62**	**160**
Total:	**195**	**2157**	**5860**

MATERIAL AND METHOD

- **The determination of saprobiological index and content of organic substances in the District Rivers**.

a) *The saprobiological index (Method Pantle-Buck*) – method which bases on the saprophyte system.

For all biological indicators it is established a saprophyte zone using the organisms (indicators) list, saprophytes from the reference material. The list of saprophyte organisms serves for the saprobiology appreciation.

To the biologic indicators is attribute a numeral value 's' corresponding to the saprobiological grade like this: in the case of oligosa simple zone s=1, for β s=2; for ά s=3; for the multi sample s=4.

The saprophyte index can take values in the domain 1- 4. [2]

b) *The dissolved oxygen* is the most important quality parameter of spring water and lake waters; it is the content of dissolved oxygen because the oxygen has a vital importance for aquatic ecological systems.

Just like this, the content of oxygen from natural waters must be of at least 2mg/l, while in lakes, especially where fish forms exist, the content of dissolved oxygen must be of 8-15mg/l.

c) *The biochemical oxygen consumption (CBO5*) represents oxygen quantity estimated in mg/l, necessary in the oxidation of organic substances from waters, with bacteria help.

The biological mineralization of organic substances represents a complex process, which in the case of waters rich in oxygen produces in two steps.

On the first step especially the carbon from the organic substratum oxidizes (carbon phase) and on the second phase nitrogen oxidizes (nitrification phase). [3]

From laboratory results it was concluded that determination of oxygen consume after five days of incubation tests (CBO_5) is sufficient.

Because CBO_5 necessities a five day determination for passing these short coming chemical and distinctive oxidation, methods are used fallowing the oxidant nature and reaction mood.

Two types of indicators are known:

-CCOMn determination –represents the chemical oxygen consume by oxidation with KMnO4 in H_2SO_4 medium. This indicator correlates best with CBO_5 with the observation that they are over oxidized and approximately 30-35% from organic substance is no degradable.

To evaluate the quality of surface waters from Gorj district, regarding the content of dissolved oxygen, CBO_5, CCOMn, were cropped and analyzed water samples from: Sadu, Balteni, Racari, Cruset, Hurezani, Negoiesti, Albesti rivers. [4]

- **The suspensions content determinations, chlorides and stable residuum in the District Rivers.**

a) In function of the water source each value of turbidity correspond a certain value of suspensions content.

The matters in suspension can be easily decant able and hard decant able (colloids).The matters in suspension are determined by the gravimetric method (of weight).

A certain volume sample, well homogenized is filtered on a filter paper or membrane, eventually weighted at $105^{O}C$, analytical balance.

The content determination in suspension can be made by turbidity measures and by anemometric methods, establishing the regression curves for each water type.

The type which applies to suspension determinations is: **STAS 6953/81.**

b) The chloride molecule is present in natural waters, coming from soil or as pollution result. The chloride molecule not necessarily toxic for the human being, neither in small concentrations of 0-30 mg/l and for the underground waters from ground-water layer are present in concentrations of 5-15 mg/l.

The stas method which applies for chlorides determinations is: **STAS SR ISO9297/96.**

c) The stable residuum represents the totality of substances dissolved in water established after the evaporation process at 100^0C, the majority of those are of inorganic nature. The value of stable residuum in different natural waters vary in function of rocks characteristics with whom the mater touch with the water .It is determined through the evaporation process of a water sample filtrated through quantitative filter paper or centrifuged (water without suspensions) and the weightening of the remained residuum after the evaporation process and drying at 105 ^{0}C and also expressed in mg/l.

The method which applies for the stable residuum determination is: STAS 9187/1984.

RESULTS AND DISCUTIONS

After the biological analyses at rivers from Gorj district the value of saprophyte index is of 2.3, fact which represents the third class (beta-mezo-sample), the ecological state is satisfying.

The obtained values are emphasized in *table 2* and *table 3* (in comparison with).

To compare the values with the limit of second class quality of surface waters which were graphically presented in *fig.1* and *fig.2*. [4]

Table 2

The content of organic substance of Sadu, Balteni, Racari rivers

Organic substances	Rivers			The second class limit
	Sadu	Balteni	Racari	
The saprophyte index	1.89	1.92	1.72	2.3
O2	9.4	10.2	9.5	6
CBO5	3.8	3.4	3.6	5
CCOMn	7.2	7.1	6.6	10

Table 3

The organic substances content in Cruset, Hurezani, Negoiesti, Albesti.

Organic substances	Rivers				The second class limit
	Cruset	Hurezani	Negoiesti	Albesti	
The saprophyte index	1.32	1.81	1.89	1.92	2.3
O2	9.9	9.6	8.6	8.3	6
CBO5	4	3.8	4.2	4.8	5
CCOMn	6.6	5.9	8.5	9.3	10

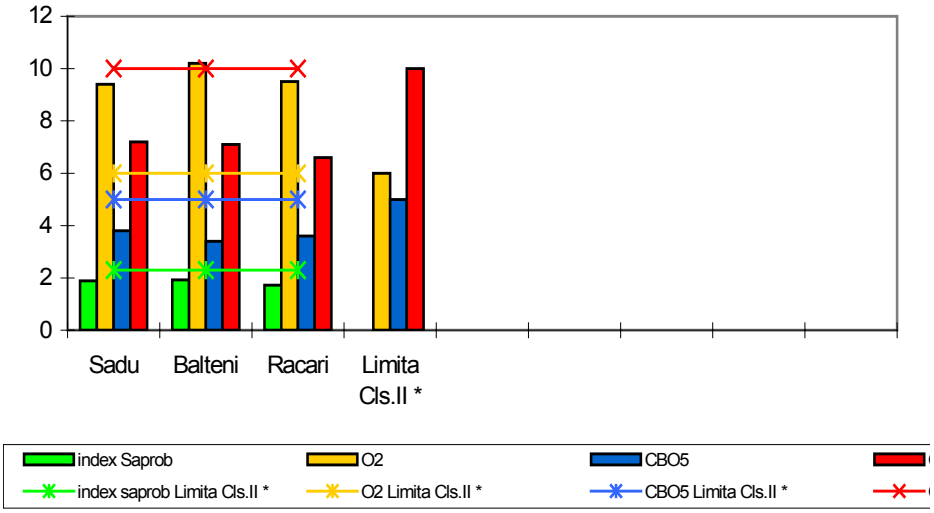

Figure 1. **The variation of dissolved oxygen CBO_5, CCOMn in Sadu, Balteni, Racari rivers in comparison with the limit of the second class quality**

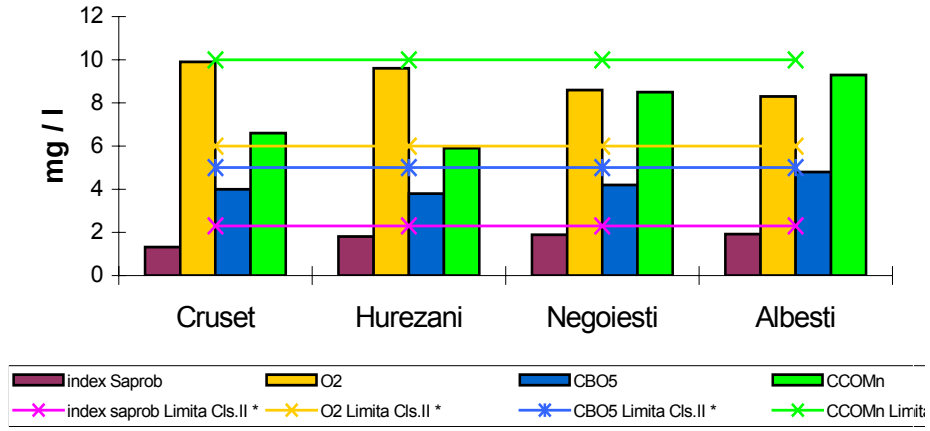

Figure 2. **The variation of dissolved oxygen CBO5, CCOMn in Cruset, Hurezani, Negoiesti, Albesti rivers in comparison with the limit of the second class quality**

To evaluate the rivers quality from Gorj district from suspensions part, samples were cropped from water in the Jiu-upstream section, Sadu confluence and the annual averages during 1996-2006, graphically presented in *fig.3.* [4]

To evaluate the rivers quality from Gorj district, regarding chlorides, samples were cropped in Cioiana –upstream section, Jiu confluence and annual averages during 1996-2006 are graphically presented in *fig.4.*

To evaluate rivers quality from Gorj district, regarding the stable residuum, the annual averages from 1996-2006 are graphically presented in *fig.5.*

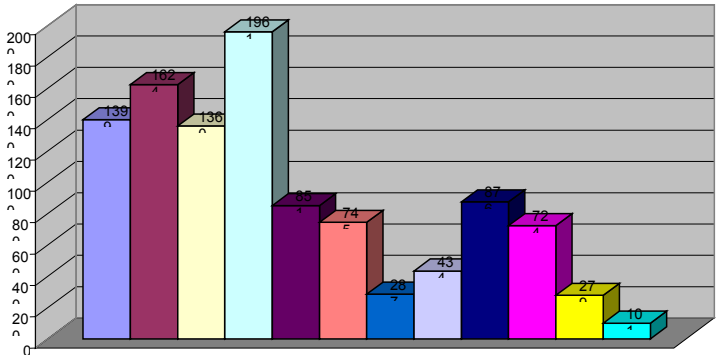

Figure 3. **The evolution of suspension indicator in Jiu-upstream section Sadu confluent during 1996-2006**

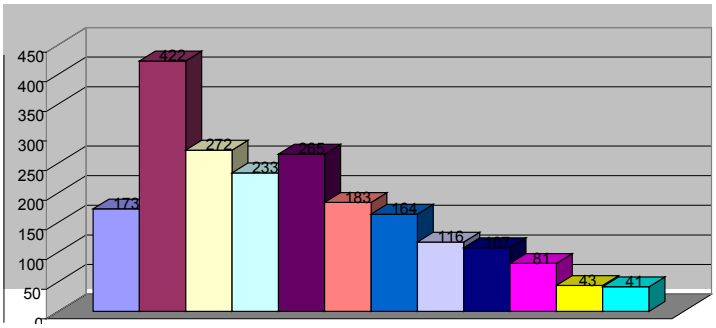

Figure 4. **The suspensions indicator evolution in Jiu-upstream section, Jiu confluence between 1996-2006**

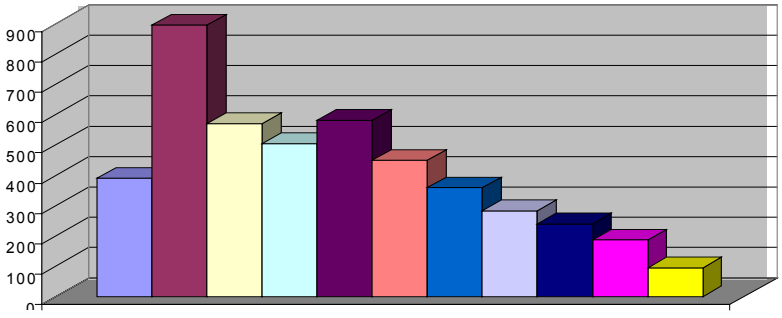

Figure 5. **The evolution of stable residuum indicator in Cioiana-upstream section, Jiu confluence between 1996-2006**

CONCLUSIONS

The drainage of Gorj district totalizes rivers with superior reservoirs height mountain area and very good water because afferent surfaces of reservoir are not affected by industrial activities.

A major influence over natural waters quantity is represented by evacuations of used unpurified waters or purified ones; discharged in natural receivers. The functioning situation of purification stations has not met a significant improvement.

Pollution sources of rivers from Gorj district are: the petroleum industry, the thermo-energetic industry, and the alimentary industry and livestock farms.

To evaluate rivers quality from Gorj district water samples were cropped from rivers like: Sadu, Balteni, Racari, Amaradia, Hurezani, Negoiesti, Albesti and the saprobiological consume index , the dissolved oxygen, the biochemical oxygen, the suspensions, the chlorides, the stable residuum and the obtained values which were compared with the limit of the second class quality.

The value of saprobilogical index for district rivers is: 2.3 –ecological state being satisfying (β-mozosa sample).

The dissolved oxygen content has bigger values than the limit of second class quality for all analyzed rivers.

The evolution of suspension indicator was presented during 1996-2006 in Jiu-upstream section, Sadu confluence, being obtained the biggest value in 1999.

The evolution of chloride indicators and stable residuum was presented during 1996-2006 in Cioiana-upstream region, Jiu-confluence obtained the biggest value in 1997.

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