Studies and Researches for Water Resources and Environmental Protection Program

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This paper presented experimental studies and research carried out on a laboratory plant to optimize the exploitation of rapid filters factory equipped with homogeneous granular media. Filter material used was composed of quartz sand, with increasing grain size as the current flow direction (d = 0.3 to 3.0 mm) and layer thicknesses of 50-60 cm. The experimental research carried out for different concentrations and different filtration rates determined optimal values of operating parameters to ensure a good quality filter and constant flow during the filtration cycle.

Keywords: downward filtration, filtering medium, optimal filtering cycle, operating parameters, speed filter, homogeneous quartz sand

Within the complex protection program of water resources and the environment, rapid filtration is the process that ensures completion of the rinsing process of water supply for drinking and industrial purposes.

Large variety of filtration plants, in terms of the composition and functioning requires detailed knowledge of each process so that a judicious choice and rational exploitation to ensure good quality of water at the lowest possible cost price [9- 12].

Rapid filtration must be considered as an essential component of all the processes needed for the clearing of underground and surface water with the purpose that in the optimal deployment, favoured by the chemical pretreatment and settling processes, to succeed perfection of the rinsing process.

In value terms, the filters are on average more than 30% of total investments allocated to treatment plants. This finding led the specialists, who work in this area to pay special attention to filtration, which has generated numerous studies and researches that led to continuous improvement of constructions and filtering plants.

The researches refers in particular to knowledge and the profund study of water filtering mechanisms, the development of mathematical models of filtration, filter material choice and optimization of filtration rates, so that filtered water to be the best quality, in sufficient quantity and at the lowest cost price.

Homogeneous materials can be increasing or decreasing grain layers depending on the direction of water filtration (downward or upward). These materials should be resistant enough so that in case of repeated washing the structure size to be maintained on periods of time as long as possible [1-3].

Theoretical considerations

To establish the optimal parameters involved in the process of separating the suspensions from water, it is required intimate knowledge of all phenomena that arise from the passage of water through an aqueous medium.

If we know the mechanisms which contribute to the rinsing process we can determine the optimum filtration rates, thickness and granulometry of filter media and dosage of reagents, so that the lifetime of the filter between the two washings to be as high as possible [7, 9].

For a complete description of the phenomena involved in the process of rapid filtration it is necessary to consider simultaneously both physical and chemical factors.

Mechanisms involved in the removal of particles in suspension from water are dependent on: the filtering medium density, filtering medium granulometry, filtering medium depth, the speed of filtering; the water column above the filtering medium, the concentration of particles in suspension from raw water; temperature, density and viscosity of the fluid [7, 9].

The experimental research found that the quartz sand grains are loaded with negative electric loads, but the effect of the electrostatic potential is reduced by aluminum or iron floaters adhesion. If the particles have not enough kinetic energy, then they will be strongly attracted to the grain surface.

Finally, it was agreed that the removal of particles from the water passing through the filter is due to transport, attachment and detachment mechanisms [3, 4].

The researches made until now on laboratory facilities or factory filters, established that in the first part of the filtration, effluent turbidity is reduced gradually to a value which remains constant throughout the treatment period after which it begins to grow, to the maximum quality allowable by current technical norms [11, 12].

Qualitative and quantitative changes in the rapid filtration proccess

Taking into account a filtering layer, consisting of sand, of thickness x, through which is filtered a flow Q, with a concentration C_0, initial concentration changes in relation to the filtering thickness, develops experimentally an exponential law, evidenced for the first time by [3]:

$$C = C_0 \cdot e^{-\lambda \cdot x} \quad (1)$$

$$\ln\frac{C}{C_0} = -\lambda \cdot x \quad (2)$$

where:

C_0 - the initial concentration of the effluent in suspensions, in mg/dm^3;

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Utilizarea filtrării ascendente în procesele de limpezire a apei

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The paperwork studies the opportunity of using ascendant filtration in drinkable and industrial waters clearing technology. Ascendant filters equipped with homogenous or non homogenous granular materials, with descendant granulation depending on the flow's direction, are installations which, at usual filtering speeds, are helping the use of the filtering environment increasing in the same time the clearing and filtration cycles' degree. The experimental researches pointed out the good results of ascending filters, as compared to the descendant ones, usually equipped with the same type of material.

Key words: ascendant filtration, descendant filtration, multiple homogenous layer, multiple non homogenous layer, filtering speed, specific deposit.

Filtrarea este procesul de limpezire prin care se asigură se[illegible]area suspensiilor din apă, prin trecerea acesteia prin n[illegible]ii granulare sau poroase, alese in raport cu sensul de curgere al apei şi de scopul propus.

În funcţie de mărimea vitezelor de filtrare, de sensul curgerii apei, de natura şi structura mediilor filtrante se deosebesc : filtre lente (v=5-10m/zi), filtre rapide (v=5-10m/h) sau ultrarapide (v=20-100m/h) ; descendente, ascendente sau radiale ; omogene sau neomogene, cu strat unic sau în straturi multiple (multistrat).

În cadru tehnologiilor actuale de limpezire din cadrul staţiilor de tratare a apei sunt utilizate cu precădere filtrele rapide descendente cu strat unic de nisip.

Filtrarea rapidă în tehnologia de tratare a apei, în scopuri potabile şi industriale este utilizată fie ca treaptă unică de limpezire, ca treaptă preliminară (prefiltrare) sau ca treaptă finală, pentru finisarea indicatorilor de calitate ai apei [1, 2, 11].

[illegible]cesele de limpezire prin filtrele rapide sunt fenomene d[illegible]sebit de complexe determinate de: caracteristicile s[illegible]stanţelor disperse din apa de limpezit (natura, mărimea, co[illegible]entraţia şi starea de agregare a acestora în apă) ; ca[illegible]teristicile mediului filtrant (natura, tipul şi structura m[illegible]eralogică a straturilor, mărimea şi forma granulelor, porozitatea şi grosimea stratului (straturilor);condiţiile hidrodinamice ale procesului (vitezele de filtrare, sensul mişcării, eficienţa spălării mediilor filtrante omogene, mono sau multistrat) [10].

Filtrarea rapidă ascendentă prin straturi multiple omogene şi neomogene se înscrie pe linia cerinţelor şi a orientărilor actuale cu privire la creşterea productivităţii şi a gradului de limpezire prin sporirea capacităţii de utilizare a straturilor filtrante, concomitent cu majorarea vitezelor şi a ciclurilor de filtrare [7,8].

La filtrarea rapidă ascendentă, procesele de limpezire sunt asemănătoare cu cele de la decantoarele suspensionale, deosebirile fiind determinate de modul în care sunt alcătuite masele filtrante.

Materialul filtrant, la filtrele ascendente este alcătuit, de regulă, dintr-un strat de nisip omogen având granulaţia descrescătoare după direcţia de curgere a apei, iar la decantoarele suspensionale, masa filtrantă este alcătuită numai din suspensiile reţinute pe durata procesului de limpezire.

În ambele cazuri, vitezele maxime de curgere prin masele filtrante sunt limitate de evitarea fenomenului de fluidizare a materialelor filtrante, a materialelor sau a suspensiilor din stratul suspensional.

Cercetările teoretice şi cele experimentale au scos în evidenţă interacţiunea dintre parametrii determinanţi, astfel încât odată cu majorarea capacităţii de reţinere a mediului filtrant să crească debitul de limpezire, în paralel cu majorarea ciclurilor de filtrare.

Realizările din tehnica limpezirii apei au fost orientate în direcţia promovării atât a membranelor filtrante cât şi a filtrării ascendente prin mase granulare omogene cu scopul de a se asigura uniformizarea distribuirii reţinerilor pe toată grosimea stratului filtrant.

Această cerinţă a fost determinată de faptul că la filtrarea descendentă (clasică) prin straturi omogene de nisip, distribuţia reţinerilor în adâncime este de natură exponenţială, mai mare în straturile superioare de la suprafaţă şi mai mică în cele inferioare de adâncime.

În vederea eliminării acestui neajuns, masa filtrantă a fost constituită din materiale neomogene cu densităţi variabil crescătoare şi cu granulaţii variabil descrescătoare după direcţia de curgere, astfel încât materialele mai uşoare cu diametrele mai mari vor ocupa orizonturile superioare, iar cele mai grele dar cu diametre mai mici vor ocupa orizonturile inferioare creându-se astfel condiţiile necesare pentru o distribuţie cât mai uniformă a suspensiilor reţinute.

Efecte similare se pot obţine şi în cazul filtrării ascendente prin trecerea curentului de apă printr-un strat omogen cu granulaţia descrescătoare după direcţia de curgere respectiv printr-un mediu neomogen, constituit din straturi cu densităţi descrescătoare dar cu granulaţii crescătoare după direcţia curentului.

Distribuţia suspensiilor reţinute în funcţie de tipul filtrării cât şi de structura mediului filtrant sunt redate în figura 1.

La filtrarea ascendentă prin strat omogen de nisip, distribuţia suspensiilor în masa filtrantă este similară cu

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Quantification of the Degree of Comfort given by Drinking Water Characteristics

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This paper proposes a way to quantify comfort provided by drinking water. There are treated three parameters: quality, flow and pressure of potable water to the consumer. Each of the three parameters is composed of several elements studied. It was quantified the comfort provided by each of these factors, taking as reference the values of the studied limit factors provided by law. It was obtained a final value of comfort provided by water consumption in a certain point of consumption, which corroborates the values obtained for each of the studied elements .

Keywords: Comfort, flow, pressure, quality characteristics

Water is the most important food irreplaceable. Water is a fundamental part of the human body, essential survival, with an overall 60% of body weight, 40% intracellular and 20% extracellular. Any small imbalance created between the proportions may cause serious disorders of the body.

Roles of water in human body are numerous and decisive as following structural role - the main component of human body; the reaction medium in all the metabolic processes; has a great contribution to the maintaining of homeostasis being also a source of minerals and other useful body substances.

Limited water resources in general and of drinking water in particular leads to a rational consumption of drinking water, even limited in certain areas of the world. The current trend and future is the increase the importance of water in general and drinking water in particular, due to the awareness of water quality limits sources. Earth's water reserves are mostly polluted and there are in a large decline if we relate to the growing population. Therefore, in the near future drinking water will be a strong currency for all nations. For this reason it must be a unitary standardization of drinking water characteristics and especially the comfort given by the characteristics of the water. Quantifying of the drinking water characteristics and quantifying the degree of comfort given by the characteristics of drinking water are issues which arise more acutely [1-4].

To make this process we must respect all legislation in force. There is a Primary Legislation: Law 458/2002 on the quality of drinking water with additions and changes in the law 311/2004 and Law 124/2010 approving Government Ordinance 11/2010 for the amendment and completion of Law 458/2002 [12-16,19] and Secondary Legislation: Government Decision 974/2004 for the approval of the supervisory sanitary inspection and drinking water quality monitoring, Ministry of Health Order 299/2010 approving the methodology for granting exemptions for chemical parameters of drinking water and Health Ministry Order 764/2005 for the approval of the registration at the Ministry of Health laboratories performing drinking water quality monitoring [20].

Experimental part

To illustrate the practicality of the research results, we used an approved laboratory for studying the water quality of Deva county.

We sampled water from Deva distribution network in block A2 branching point scale IV. Samples were taken 3 times per day in time intervals: [7^{00}, 8^{00}], [13^{00},14^{00}] and [21^{00}, 22^{00}], on a daily basis for 7 consecutive days within the month of June. To the scale IV block A2, living 38 people, both active and retired persons. Slots that are chosen for sampling intervals where there is maximum hourly consumption flows [11,17,18].

Note that Deva, has a complex water supply as follows: a. It captures water from the lake Santamaria Orlea near Haţeg city at a distance of 45km from Deva. The water comes from the River Râu Mare, which has a number of nine hydropowers along its middle and lower course; b. Captured water is treated in Santamaria Orlea treatment plant where the water is decanted, filtered and disinfected; c. The water is transported by gravity to a distance of about 45 Km to Deva, then is pumped back to the 11 storage tanks serving the distribution network of the municipality, which has seven pressure zones; d. When leaving the storage tank that serves consumers studied there is done a new disinfection with sodium hypochlorite; e. Water is transported by gravity from the tank to consumers. The approximate length of the pipe up to the tank to the connection from which water samples have been taken is 5.65 km.

The drinking water samples were collected in specially designed bottles which ensure tightness. Samples must be delivered to the laboratory in less than 30 min after collection. Laboratory has analyzed following parameters of drinking water: a. physical parameters: the hydrogen ion concentration (*p*H), electrical conductivity, colour and turbidity; b. organoleptic parameters: the smell and taste; c. chemical parameters: aluminum, free residual chlorine, ammonia, nitrites, nitrates and dissolved oxygen; d. bacteriological parameters: total number of colonies at 37° C and the total number of colonies at 22°C [21-26].

The parameters that have not been analyzed, have been considered ideal values, in order not to change the result of the subjective evaluation.

Table 1 presents the values recorded along the measurements:

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Considerations for Optimization of Biological Treatment Process for Small Wastewater Treatment Plant

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Wastewater treatment is particularly important to maintain a clean and healthy living environment. Through wastewater understood in this context, the dirty water from household activities, industry, public institutions or to other uses, i.e. waters whose characteristics have been changed after using. Stormwater too, under certain conditions, will not be considered conventional clean water and will be subject to treatment prior to its infiltration into the ground or discharge a receiving water. Protecting existing water resources requires quality and quantity controlling of discharges both high flow and low flow rates. Small wastewater flows, seemingly insignificant, produce little local pollution, which must be removed before they can grow. If big cities already have modern sewage treatment plants with a treatment technology well developed, small consumers raises specific issues. Therefore it is not possible direct application of treatment technologies by simply sizing for smaller capacities. In this paper the authors present some aspects of wastewater treatment from small households or from other consumers, which in terms of discharge water quality can be compared with those.

Keywords: wastewater treatment, small wastewater treatment plants, biological wastewater treatment process

The problem of small customers who do not have a centralized system for the collection, transport, treatment and discharge of wastewater is topical in our country, trying to implement rapid solutions but also technically and economically efficient. It was followed by the creation and development of rural infrastructure appropriate current standards of comfort and hygiene.

In the study was analyzed the possibility of optimizing the biological treatment process at a small wastewater treatment plant by adjusting the period of the aeration sequences of the activation basin. The experiments were performed on a pilot reactor, which is actually an industrial small wastewater treatment plant, approved in our country.

Specific requirements for wastewater treatment plants of small capacity

Classification of wastewater treatment plants based on the capacity

Classification of wastewater treatment plants, depending on their capacity, results from technological and structural differences but also from the specific operating conditions. Thus, a general classification of wastewater treatment plants based on wastewater flow is, [5]:

- Very small wastewater treatment plants
  $Q_{d.max} \le 5l/s$;
- Small wastewater treatment plants
  $5l/s \le Q_{d.max} \le 50l/s$;
- Medium wastewater treatment plants
  $50l/s \le Q_{d.max} \le 250l/s$;
- Large wastewater treatment plants
  $Q_{d.max} \ge 250l/s$.

This classification is, however, difficult to use in the current continuous decrease of water demand due to its rational use and metering.

So, it must be proposed such a classification of wastewater treatment plants that takes into account the technological and constructive differences given by the treated wastewater flow, but also by the number of the equivalent users.

A general classification of wastewater treatment plants, depending on the number of the equivalent users, according to ATV and ONORM is [6, 7]:

- Very small wastewater treatment plants 5-50 PT;
- Small wastewater treatment plants 50-500 PT;
- Medium wastewater treatment plants 500-5000 PT;
- Large wastewater treatment plants 5000-50000 PT;
- Very large wastewater treatment plants >50000 PT.

Specific problems and requirements of low capacity wastewater treatment plants

Specific problems of low capacity wastewater treatment plants

Household wastewater treatment from the small communities or isolated households raises specific problems both in design and in implementation and operation. So can be mentioned the following particular aspects, [2-4, 6].

- the low value of the circulated flows (for sizing and cheking), flows for which the self cleaning speed on the pipelines is not usually reached;
- hourly flow variation, $q_{h.max}/q_{h.min}$, is very high;
- plants are intermittently in operation, (at night or even in some hours of the day inflow may be zero);
- application of monoblock solutions, classical solutions are too expensive;
- operation without continuous supervision by individual, qualified personnel performing periodic inspection and maintenance of the stations;
- providing water of small capacity or even nonexistent;
- providing water of high quality, for example the case of stations located near the mountain tourist resorts;

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Current Trends in the Use of Small Wastewater Treatment Plant

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Wastewater treatment is required to maintain a clean and healthy living environment. There is no conceivable today to an urban or rural area, lack of a centralized channel system. Septic tanks, infiltration ponds or dry toilets, cannot be considered as alternatives. Where it is not possible or not warranted creation of a public channel system, local solutions should be adopted by a high technical level, ensuring a quality treated water that can be reintroduced in natural cycles, without restrictions. For better management of existing water resources, it is necessary to control the quality and quantity of discharges for both high flow and low flow rates, seemingly insignificant, but which are some small local polluters (punctual). This category part isolated households, motels, hotels, campgrounds, parking lots equipped with toilets, and nursing of infectious diseases, industrial objectives of small capacity, farm animal breeding, other. The paper presents the main treatment technologies and how they can be applied to small capacity facilities. Tried, based on available data, presenting as many technical details and issues involved in the operation and maintenance of facilities.

Keywords: wastewater treatment, small wastewater treatment plants

Collection, transport and wastewater treatment presents a wide range of problems in rural areas. The rural area, village, is in constant transformation, aiming to diminish the great differences between the comforts of "civilized" life from the city and of the rural public utilities. By seeking recovery in agriculture, the loss of major industries in the city that managed to absorb a part of the labor force in the village and not least the still unpolluted living environment that it provides the village, there is an increase in recent years the rural population, (not necessarily due to growth of population growth rate, but rather a return to active and retired population of the city back to the village). Occurrence in our country a new industry of tourism, agrotourism, requires raising public utilities and hydro utility default to a new standard, namely the state of the art. That means hydro utility equipment to a level that allows supply with quality drinking water and disposal and treatment of wastewater of every village households. We can assimilate the countryside and consumers resorts, sanatoriums, motel and restaurant parking feature, monasteries, etc.

Wastewater treatment plants of small and very small capacity are a solution for extreme situations, such as for example isolated communities with roads that are not always practicable. The solution was imposed at European level in recent years, with a range of treatment methods and a multitude of constructive solutions to these stations. Legislation of European countries, such as Austria, provides grants to this solution.

The disadvantage of wastewater treatment plants of small and very small capacity is that they include in their construction a complex technique, usually not accessible to the beneficiary, sometimes occurring problems that may affect treatment performance. This disadvantage can be considered only temporarily, because the wide application of this solution is developed in parallel with the maintenance services. The estimated costs related to the implementation and operation of collection, transport and treatment of wastewater are shown in table 1 [4, 5]:

Wastewater quality of the influent and treated at wastewater treatment plants of small capacity

Wastewater quality of the influent are established:

- based on hydrochemical studies performed before design;
- by analyzing the database of existing wastewater treatment plants that must be expanded or refurbished;
- by assimilating the values of quality indicators registered in other wastewater treatment plants serving localities with channel system, public utilities, social and similar industrial activities, and a similar number of inhabitants;
- by calculating the main qualitative indicators based on specific load of pollutant (g/PT·day).

Noting that if small capacity water treatment plants, wastewater influent is predominantly of domestic nature.

The main quality indicators are:

-biodegradable dissolved organic matter or as suspended particles, usually expressed by biochemical oxygen demand (BOD);

- biodegradable and non-biodegradable organic material that can be chemically decomposed expressed by chemical oxygen demand COD;

Capacity	*Costs of implementation Euro/Pt**	*Costs of operation Euro/Pt*
5 PT	2123	92
10 PT	1465	77
25 PT	965	63
50 PT	765	53
100 PT	643	45
150 PT	593	40
200 PT	572	38

*) *Total number of inhabitants and population equivalents (PT)*

Table 1
ESTIMATED COSTS OF IMPLEMENTATION AND OPERATION OF SMALL WASTEWATER TREATMENT

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The Eficiency of Resita Town Water Treatment Plant

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The main source of water supply for the residents of Resita town is Bîrzava River. Water is extracted from the settling basin of Crăinicel Hydroelectric Power Plant located on Bîrzava River, upstream of Resita town. The water treatment station, with 1 m³/s discharge contains in its technological line the following items: kitchen reagents, reaction tanks, clarifiers, filters, chlorine disinfection and storage tanks. Water quality measurements, at the entrance and exit of water treatment plant were made for a two year period (2010 - 2011). Analyzed quality parameters in this paper are: water turbidity, pH, water oxidation, ammonium, nitrate concentrations. The average yield reduction of presented parameters was between 1.93 (for pH)), and 49.61 (for ammonium). The comparison of values from analyzed parameters at the exit of water treatment plant with the current regulation ones for drinking water allowed us to conclude that the supplied water to residents of Resita town corresponds in terms of quality, to a good quality drinking water.

Keywords: drinking water, water treatment plant, quality parameters, technological line, Birzava

The technology used at Reşiţa water treatment plant

The water source for drinking water of town Reşiţa, subject to purification at the water treatment plant is situated at the surface. Water from the calming pool of Hydroelectric Power Plant Crăinicel is pumped to the water treatment plant (fig. 1).

Water Treatment Plant Reşiţa produces 1 m^3/s drinking water. Ground level at which the plant is located is between 300 and 315m.

The plant is composed of reagent dosing installations, mixing chamber, sedimentation tanks and filters. Water disinfection is made by chlorine gas in the contact tanks.

Reagent dosing is made by a line for lime and another for aluminium sulphate used for coagulation.

The lime line is composed of a lime deposit, a pool of 1 m^3 used to slack lime, pumps which send "milk" lime into two containers of 2.5 m^3 for diluted suspension, and 1+1 recirculation pumps towards the containers with dispensing nozzles.

Sulphate aluminium line comprises a pool of approx. 30 m^3, decanting pumps of the concentrated solution in two dilution containers of 2.5 m^3 from where the diluted solution is pumped into containers with dispensing nozzles and recirculation of excess solution.

At the reagents household floor we find the analysis laboratory, reagents storage, a locker and bathroom.

The mixing chamber has a volume of 42 m^3 and provides a contact time of 42 sec.

The two sedimentation tanks with a diameter of 32 m and a volume of 4800 m^3 each, ensuring a flow rate of 500 l/s with a settling time of 2.6 h.

The Plant is equipped with 24 sand filter tanks with a total area of 572 m^2.

Purified water is stored in tanks inside the treatment plant, with a total capacity of 5000 m^3.

At a flow rate of 1 m^3/s the time it takes the water to pass through the treatment plant reservoirs is 1.25 h.

Treatment plant analysis laboratory

The treatment plant analysis laboratory is structured in 3 units with different functions:

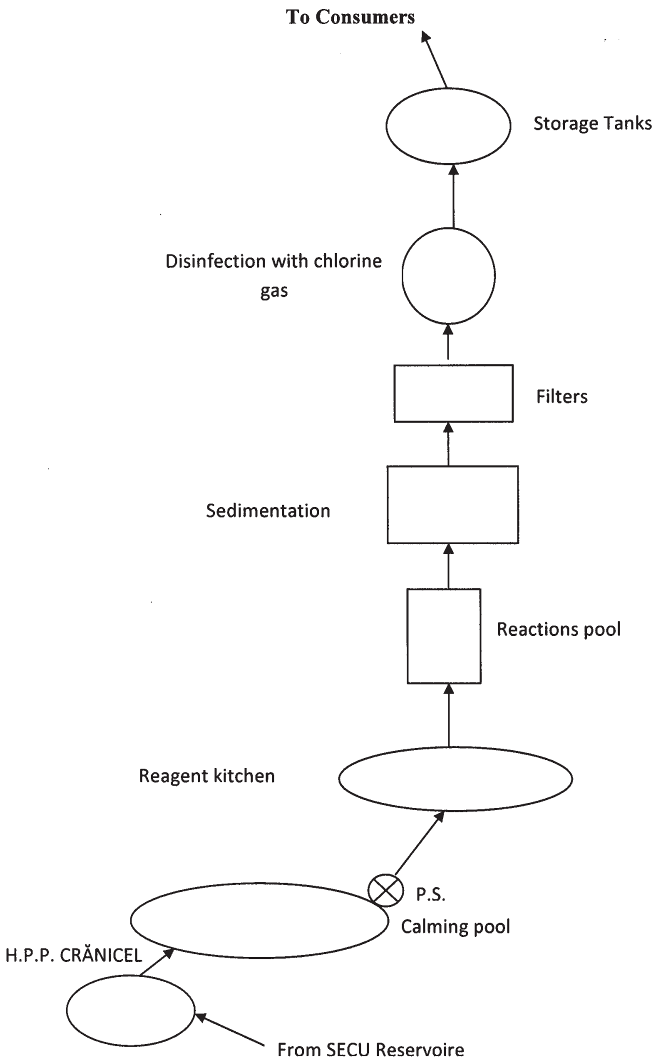

Fig. 1. Water Treatment Plant of Resita Town

Technological Laboratory of physico-chemical raw and decanted water- wherein quality indicators are determined for raw water to properly establish reagents dosage, as well as quality indicators for the technological steps in order

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Determination of Mobile Phosphorus Fraction in the Soil Variety Taxonomy Using Ammonium Lactate-Acetate

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Currently in the case of agrochemical research of the agrarian soils mobile phosphates are calculated, represented by the monophosphate ($H_2PO_4^-$) and diphosphate (HPO_4^{2-}) ions which are usually retained on the soil particles surface associated with sescvioxides, with other minerals components of clay or with the calcium and magnesium ions . Thereby, the mobile phosphates came in contact with the soil solution and determined its concentration in phosphates ions. During the soil evolution, phosphorus from apatite is altered and transformed through precipitation by other secondary minerals or by undertaking by plants or microorganisms in other organical or inorganical phosphor compounds [2]. In the acid soils secondary phosphorus minerals formed contain Al and Fe phosphates, in the type of variscite and strengite [6]. In the neutral and alkaline soils various types of Ca phosphates are found.

Keywords: monophosphate ions, diphosphate ions, sescvioxides, mobile phosphates, primary minerals, secondary minerals

Even if soils contain less phosphor comparative with the others essentials macronutrients (N, K), this element role is highly important, and the chemical processes where it interferes much more complex. Currently phosphorus is considerate a primary macronutrient, with a major role in growing and plant development.

Phosphorus favours nutrition, growing, blossom and fructification processes, depositing carbohydrates in fruits, sugar beet, tubercules. It reduces the typical water consumption of plants. It is accumulated in young organs and seeds. In the absence of phosphorus the plants remain small, the roots are long and rare, the stems are hardened, and the leaves are dark-green till blue-green and in many cases with red or purple color. Besides, the phosphorus involvement in many important processes, the agricultural literature presents numerous examples of cereals and fodder where optimum phosphorus fertility is maintained in the arable soils.

Experimental part

Materials and methods

The mobile phosphorus fraction from soils is determined in ammonium acetate-lactate solution, according to STAS 7184/82.

Range of application:

- method of extractible P determination in ammonium acetate – lactate solution from *p*H = 3.75 (the Egner – Riehm – Domingo method), conventionally considered a measure of accessible phosphorus (mobile).

· P accessible to the plants nutrition is found as orthophosphate ions (monovalent $H_2PO_4^-$ or bivalent HPO_4^{2-}, depending of soils *p*H) in the soil and solid soil phase solution (as adsorbed ions or in chemical combinations, mostly with the Fe^{3+}, Al^{3+}, Ca^{2+} ions).

The methods

The phosphate anion considered conventionally accessible for the plants is brought to solution by desorption and leaching reaction, dissolution and complexing reaction, reactions that take place at the ammonium acetate – lactate solution (*p*H 3.75) with the soil constituents interaction that retain the phosphate anions adsorbing them or contains them as anions in chemical combinations with Fe^{3+}, Al^{3+}, Ca^{2+} ions. The phosphate anion extracted is colorimetric determined as molybdenum blue, through the phosphomolibdenum complex reduction with ascorbic acid or in mixture with reducers.

The phosphates considered easily accessible to the plants are those extracted from soil with a ammonium acetate – lactate solution stippled with *p*H = 3.7, called AL solution.

The phosphates from soil are found as primary, secondary, tertiary, octocalcium phosphates, adsorbed at the iron or aluminum sescvioxides or clay surface, which is hardly soluble.

In the neutral and alkaline soils, phosphates are solubilized mostly by the acetic acid which is a component of the AL solution:

$$CaHPO_4 + 2CH_3COOH \rightarrow Ca(CH_3 - COO)_2 + H_3PO_4 \quad (1)$$

$$Ca_4H(PO_4)_3 + 8CH_3COOH \rightarrow 4Ca(CH_3COO)_2 + 3HPO_4 \quad (2)$$

In the low acid and acid soils, where a large part of phosphates are retained on the sescvioxides surface, strongly interfere the lactic acid, that has an week aluminum, iron and calcium complexing action (Al^{3+}, Fe^{3+}, Ca^{2+}):

$$Al(OH)_2H_2PO_4 + 3CH_3CHOHCOOH \rightarrow \rightarrow H_3PO_4 + Al(CH_3CHOHCOOH)_3 + 2H_2O \quad (3)$$

$$Fe(OH)_2H_2PO_4 + 3CH_3CHOHCOOH \rightarrow \rightarrow H_3PO_4 + Fe(CH_3CHOHCOOH)_3 + 2H_2O \quad (4)$$

The phosphoric acid released, treated with ammonium molybdenum in acid environment forms ammonium phosphomolibdate in the presence of a strong reducer ($SnCl_2$) resulting a blue color compound:

$$H_3PO_4 + 10(NH_4)_2MoO_4 + 22HCl + SnCl_2 \rightarrow \rightarrow (2MoO_2 + 8MoO_3)HPO_4 \cdot 2H_2O + 20NH_4Cl + SnCl_4 + 10H_2O \quad (5)$$

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Modelling of Depollution Process in an Aquifer through Injection and Extraction Wells and Treatment of Polluted Water at the Ground Surface

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Environmental protection is a very important component of the lasting development concept. The care of giving the future generations enough resources to a growing society should concern the quality as well as the quantity of our actions. For this reason the protection of the ground water resources should be carefully handled. Because of the slow flow rate of the ground water, the effects of a present pollution could have repercussions on the environment for tenths of years from now. Unearthing the pollution sources and using the adequate de-pollution procedures could protect efficiently the tapping of ground water. In this paper is presented the case of ground water pollution with phosphates and the aquifer de-pollution procedure through injection and extraction wells. Also there is presented a single casting treatment plant that uses the ion exchange procedure.

Key words: diffusion, dispersion, ion exchanger (ion exchange plant), phosphates, underground water pollution, degradation, resin, and infiltration

The phosphorus could be found in natural water as inorganic soluble phosphorus (ortho-phosphates: PO_4^{3-}, $H_2PO_4^-$, HPO_4^{2-}) which is directly assimilated by the plants and as organic phosphorus. The phosphates (PO_4^{3-}) represent the form in which the phosphorus is found in the most cases. The secondary phosphates ($CaHPO_4$) are less soluble in water and the primary phosphates ($Ca(H_2PO_4)_2$) are soluble in water and easy assimilated [2].

Concentration of phosphates bigger than 0.1 mg/dm^3 from underground water makes impossible to use it without a previous treatment [5].

Some of the ground water pollution reasons with phosphates are: the lack of centralized sewage systems in the rural area, the damage of the draining pipes, the conveyer pipes and the reservoirs from the fertilizers and wash detergents production plants.

A diffusive source of phosphates pollution is the unrational usage of fertilizers on agricultural terrains that are preceded by precipitations which facilitate the quick infiltration in the aquifer.

Because of the diffusion-dispersion processes, small speed displace of the underground water flow, will take place a scattering of the polluted substance followed by concentration decrease [3].

Taking rapid measures of aquifer de-pollution affected by the natural damages will drive to avoiding the scattering of the polluted substance on big surfaces, a shortage of the de-pollution period and a reduction of the expenses [4].

Calculation model of pollutants transport in underground water

Diffusive – disperse transport of pollutants in underground water, in bi-dimensional model, takes place according to the first law of Fick:

$$\vec{q} = -n_e \cdot \overset{\Rightarrow}{D} \cdot \nabla C \qquad (1)$$

$$D_L = \alpha_L \cdot v_i + D_{dif} \text{ and } D_T = \alpha_T \cdot v_i + D_{dif},\ D_L > D_T \qquad (2)$$

Pollutes which arrive in underground water are partialy absorbed by the solid matter.

$$r_a = (1 - n_e) \cdot \rho_s \cdot k_d \frac{\partial C}{\partial t} \qquad (3)$$

Once in underground water, pollutants are chemicaly and biologicaly degraded:

$$r_d = \lambda \cdot m_t \qquad (4)$$

$$m_t = m_p + m_a = n_e \cdot C + (1 - n_e) \cdot \rho_s \cdot k_d \cdot C \qquad (5)$$

The degradation rate becomes:

$$r_d = \lambda \cdot [n_e \cdot C + (1 - n_e) \cdot \rho_s \cdot k_d \cdot C] = \lambda \cdot n_e \cdot R \cdot C \qquad (6)$$

$$R = 1 + \frac{1 - n_e}{n_e} \rho_s \cdot K_d \qquad (7)$$

Transport equation, which is used by the ASMWIN program has the expression:

$$\frac{\partial C}{\partial t} + \frac{1}{R} \nabla(\vec{v} \cdot C) - \frac{1}{R} \nabla\left(\overset{\Rightarrow}{D} \cdot \nabla C\right) - \lambda \cdot C = 0 \qquad (8)$$

By solving the transport equation we shall determine the function C=f(x,y,t), through a numerical method based on stochastic walk method “Random Walk”. This is a statistical method that has at base the transport equation for particles of pollutant. The pollutant particles are moving in trajectories dictated by convective motion and the diffusion-dispersion effect is simulated on statistical way by generating trajectories for each particle in successive time periods.

Statistic generation of the trajectories for each particle has at base the relations:

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