Study of Chemical Pollutants and the Methods of Economic Reconstruction of the Rovinar Basin

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Abstract

Soil being considered as a resource at anyone's disposal in quantities at its discretion, so there is currently no interest from economic agents to recover and use it efficiently. At the global level, both law and NGOs increasingly require ongoing land use monitoring for the purpose of soil conservation, requiring studies, field and laboratory investigations, prevention, prevention and control projects, methods and techniques. The paper will focus on the analysis of chemical parameters and pollutants (pH, humus, SB, T, total content of N. P, K, Ca, Mg, total Fe, Mn, Cu, Co, Ni, Pb, sulphites, nitrites, pesticides, complex hydrocarbons), the concentration of heavy metals (Cd, Hg, Zn, Pb) of the objectives in the Rovinari basin.

Keywords: *flotation, shaking table, recovery, tetrahedrite*

Introduction

The purpose of this paper is to provide answers on the importance of the concept of ecological reconstruction, but also to highlight the long-term advantages of its implementation in the context of the management of chemical polluted soils and the concentration of heavy metals in the soil-plant-fruit circuit in the mining objectives in the Rovinari basin. [3, 4, 5]

The paper wishes to provide answers as to how prepared we are, as consumers, to understand this necessary change of approach to how to consume products from these mining areas. To contribute actively through methods of quality and innovation in the field of the environment, to accept and adapt in this direction, and last but not least, how willing we are to participate from a cross-responsible perspective in order to quantify the implementation and gradual development of the new vision in Romania regarding the ecological reconstruction of soils polluted chemically in mining areas. [12]

The importance and necessity of addressing this issue is the continuing decrease in the amount of non-renewable resources worldwide, along with the continuing increase in global population, putting pressure on new approaches to the use and restoration of chemically polluted lands. In this context, a gradual step from a linear economy to a circular economy would have a good environmental, economic and social impact. Under these circumstances, the United Nations has underlined the importance of sustainable development, as defined in principle number 3 of the Rio Declaration, as the right of a country to develop only by taking into account "equitable satisfaction of both developmental and the environment of present and future generations." In order to promote such sustainable development, a new business model is a necessity, one that can take into account the principles of sustainable development. [8, 9, 11]

Transposing the provisions of Directive 2013/34/EU, on Transparency Rules for Mining in the Mining Law on Transparency in the Exploitation of Natural Resources, which includes a set of clear and concrete principles of integrity and accountability that guarantee the management of natural resources to the benefit of the state and with real economic and social benefits. [13]

In order to provide citizens with assurance as to how the state manages, concessions to exploitation, exploits mineral resources, and fails to violate fundamental rights to safety, property and ecological balance, clear and concrete measures of transparency need to be adopted, integrity and responsibility in the exploitation of natural resources.

Research methodology

Studies will primarily focus on soils polluted chemically in the Rovinari mining basin. The study will consist of two parts, namely:

1) Soil sampling in the Tismana waste area. This step is designed to determine the composition and characteristics of chemically polluted soils, the results of a concrete index in the subsequent way of map development with the distribution of chemical pollutants needed in the planning of the ecological reconstruction step, eco-system functionality. [10]

2) Research by experimental methods based on soil chemical characteristics to identify new models of ecological reconstruction of chemically polluted soils. The results of this research will be a starting point in achieving the last of the objectives by establishing a link between the theoretical and practical aspects of finding suitable business models for managing these chemically polluted soils. [2, 3, 9]

3) Organic rehabilitation of chemically polluted soils for their reuse in agriculture, as fruit crops with apple and hazelnut varieties, raspberry and blackcurrant crops; all these activities will be done with a view to gathering accurate, accurate and accurate information so that it is possible to resort to the final stage of proposing a model of ecological reconstruction of chemically polluted soils in order to increase the degree of use and rational reuse of polluted land.

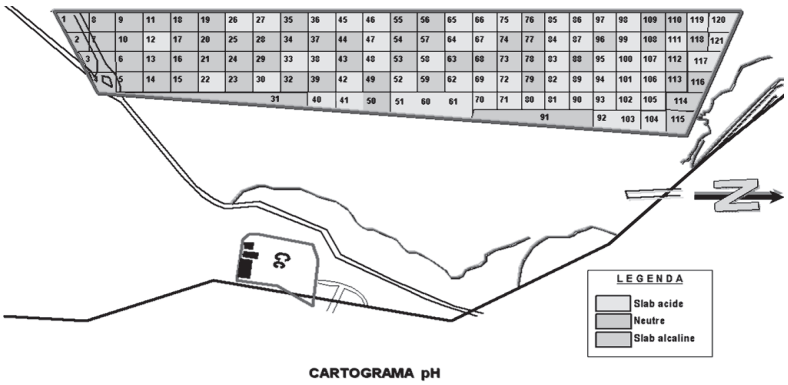


Fig. 1. Cartographic pH

Fig. 1. Cartographic pH

The agrochemical study compiled the following phases of work: A. Preparatory Phase, B. Field Phase, C. Laboratory phase, D. Phase of office, E. the final phase. [3, 11]

A. Preparatory Phase

This phase included the following actions: the link with the beneficiary unit (EM Rovinari); preparing the topographic base for the study of agro chemistry; preparation of field materials for harvesting agrochemical soil samples.

B. Field Phase

It consisted of the following actions: presentation to the beneficiary unit, drafting of the work plan, recognition of the territory; the actual harvesting of agrochemical soil samples; guidance and field control.

The following are written on the working plan: the perimeter surface; the number of harvested samples.

From the 30-hectare area of the Tismana II internal heap, 121 samples of agrochemical average soil were harvested.

The area of the harvest plot was 0,25 ÷ 0,30 ha at the plan scale of 1: 2000, and the harvesting depth was 0 ÷ 20 cm.

C. Laboratory phase

This phase took place at the laboratory of the Gorj Office for Pedological and Agrochemical Studies and covered all laboratory operations from the moment the samples arrived at the laboratory and until handing over the cartography analysis bulletins.

Samples were recorded by laboratory numbers according to the numbering system adopted by OSPA Gorj laboratory.

Large series and small series analysis were performed in this phase.

Large series analyzes

The indicators for the full range of agrochemical samples were represented by:

- pH in aqueous suspension pH H_2O – determined at soil ratio: water 1: 2.5, potentiometer with a couple of glass-calomel electrodes;
- mobile phosphorus content – determined by the Egner-Riehm-Domingo method, in acetate-ammonium lactate extract at pH 3,7 (P-AL);
- the content of mobile potassium – determined in the same extractive solutions as mobile phosphorus and K-AL respectively.

Small series analyzes

Additional indicators for small series of agrochemical samples are as follows: In 10% of the soil samples chosen to represent the main soil types in the mapped area, determine the humus content by the modified Donkey's Walkley-Black Oxidometric Method. The data obtained are used for the calculation of the nitrogen index which serves to assess the nitrogen level of the soil.

D. Office Phase

It includes the activities carried out by the cartography sector and the study sector – the agro-chemistry department – from the moment of receipt of the analysis bulletins to the finalization of the agro-chemistry file, including the endorsement of the paper.

The office phase consists in finalizing the topographic base, drawing up cartograms, supplementary analytical bulletins, diagrams and synthetic situations on soil reaction and the level of phosphorus and potassium supply.

In the phase of the office, recommendations are also made for chemical fertilizer doses, amendments, depending on the crops expected to be obtained and the supply of soil in nutrients.

As regards the soil reaction state, synthetic situation and laboratory analyzes the following results:

- 15.37 ha, representing 51% of the total area of 30 ha, have a weak acid reaction
- 12.15 ha, representing 41% of the total area, have a neutral reaction
- 2.48 ha, representing 8% of the total area, have a weak alkaline reaction.

It follows from the above that soil reaction (pH) is within optimal limits for the growth of fruit and bushes under normal conditions. (Figure 1)

Results

The ecological rehabilitation of land released by technological tasks is a slow and long process.

The greatest weight is to restore vitality and fertility to edaphic environments.

Through ecological rehabilitation (stage I), the land is attracted to the land for agricultural technologies, and by recultivation (stage II) the new edaphic environment is created to create the potential to produce economically.

SYNTHETIC SITUATION

of the soil reaction state depending on the pH in aqueous suspension

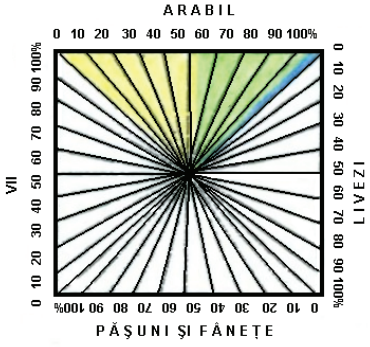
Tismana I waste material

EM Rovinari

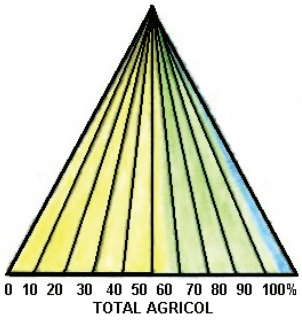
County Gorj

A. The synoptic situation of the reaction state

a. by category of use



b. on total agricultural



B. Reaction state structure by category of use

Category of use	Samples or hectares		The reaction											
			Strongly acidic		Moderately acidic		Slightly acidic		neutral		Slightly alkaline		Moderate / Strong alkaline	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Arable	samples	121	-	-	-	-	62	51	49	41	10	8	-	-
	ha	30	-	-	-	-	15.37	51	12.15	41	2.48	8	-	-
pastures	samples	-	-	-	-	-	-	-	-	-	-	-	-	-
	ha	-	-	-	-	-	-	-	-	-	-	-	-	-
Rough	samples	-	-	-	-	-	-	-	-	-	-	-	-	-
	ha	-	-	-	-	-	-	-	-	-	-	-	-	-
Are you coming	samples	-	-	-	-	-	-	-	-	-	-	-	-	-
	ha	-	-	-	-	-	-	-	-	-	-	-	-	-
orchards	samples	-	-	-	-	-	-	-	-	-	-	-	-	-
	ha	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural	samples	121	-	-	-	-	62	51	49	41	10	8	-	-
	ha	30	-	-	-	-	15.37	51	12.15	41	2.48	8	-	-
The color legend														

At the analyzed objective, the Timsmana II indoor waste dumps, with a surface of 30 ha following the reconstruction of the lands, resulted in flat, slightly inclined surfaces, the land being suitable for productive agricultural and forestry activities.

The new environment created by the arrangement has good physical and chemical properties for the root system to develop under normal conditions in most of the anthropic ecosystems practiced in the area.

Under these conditions, a structured recultivation program is recommended for the designer for at least 2 years as follows:

- in the first year to practice cultures that could be used as green fertilizer, if possible two crops per year,
- in the second year, to plant fruit trees and fruit bushes practiced by the agricultural producers in the area (apple, hazelnut etc.).

The structure of crops in the 2 years is the following: jar-rye green-lucerne-goat mass. The four cultures can be grouped into at least two variants:

Variant l

– year I – jar-rye green meal

– 2nd year – apple – hazelnuts

Variant 2

– 1st year – lucerne – naked

– 2nd year – fruit shrubs

It also incorporates all remaining plant remains after harvesting of bark, clover and alfalfa.

The need for mineral fertilizers is ensured according to the fertilization plan for each crop individually and every year.

If by applying a complete technology the production results for each crop are economic, after 3 years of re-cultivation land can be handed over to the beneficiaries.

Otherwise, the process of re-cultivation continues, focusing on works aimed at increasing the production capacity.

In case of planting of forest plantations, two variants are recommended:

- variant l – fertilizer spread over the entire surface and saplings planting
- variant 2 – setting up orchards, planting seedlings with fertilizers at the planting pit (without touching the roots) on land with a slope of more than 10%.

Need to apply organic-mineral fertilizers

In order to complement the stock of nutrients in the soil in order to obtain large and economically efficient crops for all crops and all uses, it is necessary to apply organic-mineral fertilizers.

Types of recommended organic-mineral fertilizers can be applied to the range of crops proposed within the Biological Recultivate Project at the tailings dumbbell Tismana II are:

– L-200 (20% N + 20% AH) = 40% active substance

– L-300 (30% N + 12% AH) = 42% active substance.

in which: AH – humic acids.

By the method and the application period, it is intended that the nutrients applied as fertilizers should be as far as possible in the active absorption zone and the utilization rate should be as high as possible.

Annual grass rotation for annual plants is carried out with the deep soil work at the time when it is recommended to perform it (usually in autumn), but also with other soil works that are done before sowing.

In the case of organic-mineral fertilizers it is recommended to apply nitrogen and humic acids.

In the case of nitrogen, phosphorus and potassium fertilizers, it is recommended that nitrogen be applied physically (both under base and during vegetation) and phosphorus and potassium entirely under the basic soil in the preparation of the sowing field at the time of application , depending on the culture to be set up.

For setting up forest plantations (hardwoods), the chemical fertilization periods are as follows:

- nitrogen – l / 2 of the nitrogen dose is applied early spring with phosphorus and potassium; 1A is given in one or two halves in the first part of the vegetation;
- phosphorus – is given early spring;
- Potassium – is given early spring (preferably potassium sulphate).

Taking into account the fact that in the long run the objective in its entirety must be ensured stability, it is recommended that the areas with slopes higher than 2-5% be arranged and used for forest productive activities.

In the fertilization plan the fertilizer and forestry (hardwood) needs were calculated.

Conclusions

The investigations carried out in the mining Rovinari between 2018–2019, several conclusions can be drawn:

Pollution caused by the up-to-date exploitation of lignite in the Rovinari mining perimeter of the soil and subsoil is a long-term local and area and relates to:

1. The degradation of the natural geological environment:
   - the impossibility of recovering the soil layer from deforested forest lands, and as a result it is destroyed;
   - roads are dislodged, excavated, transported and stored on sites down to the depths of tens and even hundreds of meters;
   - the resulting, sterile and useful mining masses acquire geotechnical features other than basic rock;
   - deposited tailings create new compaction and stability effects on new sites;
   - the physico-chemical imbalance in the basement produced by excavations and landfills is extended also in the areas pertaining to the mining perimeter.

2. Disturbance of the physico-chemical equilibrium of the geological environment caused by geological, hydrogeological and geotechnical prospecting through drillings with insignificant, inevitable and irreversible effects on groundwater and groundwater systems, on small surfaces and volumes and in limited time;

3. Soil and subsoil damage through the construction of buildings, roads, infrastructure and mining mass transport, etc ;

4. Soil degradation and decrease of fertility class on large areas, by changing the initial destination of agricultural or forest lands and organizing activities related to exploitation.

The quality of the soil environmental factor in the mining and exploitation mining perimeter is entirely negatively affected by the direct and related exploitation activities of the lignite. The same is true of the basement, where the exploitation activity effectively destroys the natural geological environment. Soil and subsoil pollution is also linked to the risk of accidents or catastrophes, which relate to:

- the risk of environmental accidents that cause lignite self-ignition in the bed or surface deposits;
- accidents or catastrophes leading to major disruptions of the geological environment, mixtures of aquifers, penetration of surface pollutants;
- the adoption of organizational measures and exploitation technologies, which do not limit the actual "in situ" action to the strict necessity and are not adapted to the specific geological structure, can amplify and diversify the complexity of the exploitation/ coal on the ground and subsoil;
- local accentuation of geological strain instability and favoring landslides and sediments.

The tailings dumps, besides the permanent occupation of the land on which they are stored, also constitute a permanent source of pollution, by the entrainment of the material and the dissolution of the metal ions.

Analyzes on soil quality indicate a decrease in nitrogen, phosphorus and potassium in agricultural land, the emergence of new types of soils on tailings dumps of the non-evolved type with surface rock on the surface.

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Badanie zanieczyszczeń chemicznych i metod rekonstrukcji gospodarczej basenu Rovinar

Gleba jest uważana za zasób do dyspozycji każdego w ilościach według własnego uznania, więc podmioty gospodarcze nie są obecnie zainteresowane odzyskaniem i efektywnym wykorzystaniem. Na poziomie globalnym zarówno prawo, jak i organizacje pozarządowe coraz częściej wymagają ciągłego monitorowania użytkowania gruntów w celu ochrony gleby, wymagając badań, badań terenowych i laboratoryjnych, projektów, metod i technik zapobiegania, zapobiegania i kontroli. Artykuł koncentruje się na analizie parametrów chemicznych i zanieczyszczeń (pH, próchnicy, SB, T, całkowitej zawartości N, P, K, Ca, Mg, całkowitej Fe, Mn, Cu, Co, Ni, Pb, siarczynów, azotynów, pestycydy, złożone węglowodory), stężenie metali ciężkich (Cd, Hg, Zn, Pb) terenów w dorzeczu Rovinari.

Słowa kluczowe: *flotacja, stół wytrząsający, odzyskiwanie, tetraedryt*