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POSSIBILITIES OF SOIL REGENERATION USING THE CAUSTOBIOLITES IN EARLY STAGES OF CARBONISATION

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ABSTRACT

In this paper is presented a comparative study on the properties of the Roşia soft brown coal and a poor soil, in order to find out the possibilities of soil quality improvement for better plant growing conditions.

There were determined the specific values of extractible humic acids content, technical and elemental characteristics and also for the poor soil, petrographic composition of soft brown coal with low sulphur and nitrogen was analyzed.

It is revealed a big difference between the organic mass values of coal and soil but a similarity between organic components types of the two samples, as determined by petrographic analysis.

These findings offered one reason for mixing a sandy soil with the studied coal. Behavior of the two types of materials was analyzed, coal and soil, during the drying process as well as the possibility to grow up plants in coal dust and improved soil.

The results recommend the introduction of soft brown coal dust into the poor soils, in order to increase the content of organic mass, humic acids and microelements in soil.

INTRODUCTION

The problem of poor soils enrichment in order to obtain a rich environment for growing different types of plants, represents an ecological and innovator preoccupation with favorable results for the enlargement of cultivated spaces.

It is interesting to find out if carbonaceous materials without another possibilities of utilization can be used in this aim [1].

It was performed a comparative study on specific characteristics of some young brown coals [2] with xyloidic intercalations [3] and poor soil samples collected from construction sites.

The objective of this study was to establish the possibilities of improving poor soil quality (especially sandy soil from construction sites), by soft brown coal dust addition.

MATERIAL AND METHOD

The physic-chemical, technical characteristics and petrographic composition for samples of soft brown coal and poor soil were investigated.

The methodology and apparatus used for these analyses are in accordance with the Romanian standards (STAS) and the respective international ASTM and ISO [4].

The petrographic maceral composition [5, 6] was determined on polished blocks in normal reflected light (RL).

RESULTS AND DISCUSSIONS

Soft brown coal and soil samples from Roşia examined. The results are presented in the Tables 1 and 2, reported to the initial partial dried with 16% (W^a , a - analytical), dried - water free and organic matter (combustible mass – water and ash free) samples.

It was noticed an essential difference in organic ratio (especially humic) of coal and soil (coal : awf = 44,55%, humic acids extractible with NH_4OH = 10,04; soil : waf = 83,19%, humic acids extractible with NH_4OH = 3,75), but a good similarity between coal and soil from the point of view of elemental content of combustible mass. This fact is important because it is favorable for soil organic matter improvement.

In the Table 3 petrographic composition is presented as macerals of organic and mineral matter [7,8], comparatively for coal and soil.

Petrographic composition revealed qualitative similarities between the constituent's types for Roşia coal and soil. This fact suggests the possibility of using the waste coal as substituent of soil organic matter.

Table 1

Chemico-technical and elemental characteristics of Roşia coal

Specification	Initial Coal	Coal partial dried 16% W^a	Dried coal (anhydrous water free)	Organic matter(combustible mass: water and ash free)
	Value (%)			
Moisture	41,52	16,00	-	-
Ash	26,05	37,41	44,55	-
Carbon	18,90	27,15	32,33	58,53
Hydrogen	1,91	2,74	3,27	5,90
Sulphur	0,73	1,05	1,23	2,25
Nitrogen	0,52	0,75	0,88	1,32
Oxygen	10,37	14,90	17,74	32,00
Total	100,00	100,00	100,00	100,00
Humic acids extractible with NH_4OH 30%	6,36	8,43	10,04	18,11

Table 2

Chemico-technical and elemental characteristics of soil

Specification	Initial Coal	Coal partial dried 16% W^a	Dried coal (anhydrous water free)	Organic matter(combustible mass: water and ash free)
	Value (%)			
Moisture	20,22	16,00	-	-
Ash	66,37	69,88	83,19	-
Carbon	7,52	7,92	9,43	56,09

Hydrogen	0,8	0,85	1,01	6,02
Sulphur	0,11	0,12	0,14	0,85
Nitrogen	0,25	0,26	0,31	1,84
Oxygen	4,73	4,97	5,92	35,20
Total	100,00	100,00	100,00	100,00
Humic acids extractible with NH_4OH 30%	3,00	3,15	3,075	22,31

Table 3

Petrographic composition of soft brown coal and soil

Maceral subgroup	**Macerals**	**Roşia coal**	**Soil**
	Value (%)		
Telohuminite (Wooden components)	Textinite	2,5	-
	Textoulminite	21,5	1,5
	Ulminite	15,0	4,8
	Total wooden components	39,0	6,3
Detrohuminite (Detritic components)	Attrinite and Densite	10,0	4,8
Gelohuminite (Gelifiated components)	Gelinite	10,0	9,3
	Corpohuminite	2,5	0,9
Another organic components	Liptinite	1,5	0,7
	Inertinite	1,0	1,7
Total organic components		64,0	23,7
Anorganic components	Clay minerals	34,8	69,4
	Ferrous minerals	1,2	6,9
Total anorganic components		36,0	76,3

Microstructural characteristics of the main maceral and mineral constituents of the two types of studied materials were recorded in reflected white light (RL).

The petrographic constituents of Roşia coal, Plate I – Figs. 1-6, show their structural genetic nature of soft-brown earthly type, with xyloide intercalations specific for its low rank.

The wooden structure (39%) is represented by textoulminite (21%), that alternates with ulminite (15%). The detritic components (detrohuminite 10%) and the gelified components (gelohuminite 12.5%) are abundantly impregnated with minerals (36%), mainly clay (34,8%). The liptinite and inertinite are rarely met (1.5 and 1 %) and do not influence coal quality.

The participation of organic matter (23.7%) is represented by unstructurated huminitic constituents, ulminite and gelinite. Porous gelinite is partial oxidated and fissured. It often shows mineral, clayey and ferrous impregnation.

The similar structure of organic components in Roşia coal with low carbonization degree, and soil, supports the idea of introducing this coal dust in order to enrich the poor soil. In this way the waste coal becomes an ecological fertilizer, that enhances the plants growth conditions.

CONCLUSIONS

1. Chemical composition of soft brown coal dust and soil are similar, but with superior values for the percent of soil mineral material.

2. The humic acids content referred to the combustible matter is approximately the same in soil and in the coal dust. Even at a high percentage of sterile, the coal waste has a higher organic content, comparatively with the soil one.

3. Petrographic composition of the two media presents qualitative similarities of organic and mineral type, but they are different from the quantitative point of view. This fact justifies the study aspect of using soft brown coal waste to supplement the poor soil organic matter.

BIBLIOGRAPHY

1. **Barca F., Roman R.** – *Procese primare de prelucrare a cărbunilor* – Ed. UPB 2002, p. 275
2. **Blum I., Barca F.** – *„Chimia şi prepararea combustibililor solizi”,* Ed. Didactică şi Pedagogică, Bucureşti, 1968, p. 21-120
3. **Predeanu G., Albăstroiu P., Cadar Gh., Slăvescu V., Panaitescu C., Barca F.** , *„Xylite Charcoal Used for Environmental Application”*, Proc. of the 3rd International Conference of The Chemical Societies of South – Eastern European Countries, Bucureşti,
   România, 2002, Vol. 2, p. 287
4. **ISO, 7404 – 2/1996 – Determination of Coal Maceral Composition**
5. ***Panaitescu C****. –„Petrografia Cărbunilor,Cocsurilor şi Produselor Carbonice”,* Editura Enciclopedică , Bucureşti, 1991, p. 420
6. ***Panaitescu C., Predeanu G****. –* „*Atlas Carbopetrografic”*, Ed. Academiei Române, 1999, ISBN 973-27-0724-0, p.264
7. ***Sykorova I., Pickel W., Christanis K., Wolf M., Taylor G. H., Flores D.*** – „*Classification of Huminite - ICCP System 1994”*, International Journal of Coal Geology, 2005, 62, ISSN
   0166-5162, p. 85-106.
8. ***Barca F., Penu A****. –* „*Uscarea*”, Ed. Printech, 2002, 120 p.