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MANAGEMENT OF WASTE IN RURAL AREAS OF GORJ COUNTY, ROMANIA

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Abstract

On the top of the ecological priority list in Romania, waste management is on the third place following the problems regarding the surface and underground water pollution, as well as that of the atmosphere. The clean-up of the landscape represents an issue largely discussed in Romania. The paper presents the advantages of waste management for the landscape, which includes: waste gathering and transfer, waste selection, waste biological treatment and the storage.
Some analyses of the constituent components of the soil are presented, in order to assess the possibility to use the compost obtained from waste household within a composting station in agricultural sector of the district of Gorj. The experimental data demonstrated the possibility of using the compost as a fertilizer on the agricultural fields.
By applying good management and treatment practices of the household wastes, one may achieve long-tern economic objectives such as: the improvement of public health as well as the protection of the natural resources by diminishing the soil, water and air contamination.

Key words: compost, management, rural, waste

1. Introduction

The household and the municipal waste, as well as waste on the outskirts of forests, orchards and pastures or worse, in lakes or rivers, represent a real hazard for the future of the society by influencing the quality of the environment and its natural evolution.

The cleaning of landscape represents a problem discussed at present in Romania, unlike the situation of the West European landscape, where it represents no longer an issue.

The measures and methods imposed step by step as well as their chronological order are materialized and exposed in a clear way in an integrated concept of waste management.

The most important developing directions within the waste management are presented as follows (Apostol et al., 2006; Bold and Mărăcineanu, 2003; Jones et al., 2005; Păunescu et al., 2002):

- the valorization, separate gathering and ecological removal in a secure way of the dangerous wastes;
- the coordination and ordering of cleaning measures (for example: selecting the proper legal forms for the functioning of the waste management; finding some suitable private third parties for taking care of operations like waste evacuation and cleaning measures side by side with the local community, the upholding and coordination of commercialization measures and safely keeping the component in the valuable materials);
- the control of the cleaning up service (through the elaboration of some balance sheets regarding the quantity of the materials, as well as the examination of the fundamental costs for an eventual continuation or variation, or improvement of the waste management objectives);
- the information and counseling of the waste generating companies in order to minimize the waste production as well as to encourage the valorization measures;

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- to conceive and issue some legal stipulations (resolutions, norms and regulations of the district council) considered as the most important legal base for waste removal with the possibility of influencing the citizen's behavior towards a reduction of waste production mentality (by regulating the wastes cleaning, the obligation to have proper waste recipients).

The concept of waste integrated management may be useful within the authorization of some treatment and removal waste equipments, for proving the understanding of waste management priorities, for prevention of waste formation before valorization and ecological removal.

The necessity of some waste storage within a global concept together with the due measures for the limitation of production and valorization in a credible manner for the population is evident.

In conformity with the fundamental norms in the process of waste removal, one has to start from the premise of a high level environmental protection.

The paper presents an analysis of the household waste management on the Romanian landscape.

2. Experimental

2.1. Gathering and waste transfer

The gathering of the domestic wastes represents a great present day issue because their volume increases with the increase in the population and of its welfare; the increase of these factors generate hazards and risk of environmental deterioration.

The variety of the wastes composition makes the process of aerobic and anaerobic degradation faster and more difficult to follow, provoking in the case of a delayed and unsanitary gathering the pollution of the air and water.

Previous to the collection operation of the domestic wastes – process performed by specialized units – there is another phase that may be considered as a 'pre-collection' realized by the tenants or the service personnel from the public locals, stores or institutions.

The transfer refers to the moving of the wastes from the first collecting vehicle to a secondary one, bigger and more efficient.

While the systems of waste management have a collection structure, not all the systems have the transfer one.

2.2. Waste selection

The European policy in the environmental field stipulates that the waste selection has to be made in one unique fraction, as much as possible at the source. This operation has to be followed by the waste gathering and separate elimination, where their nature is known. This is an important aspect both from the ecological point of view as well as from the sanitary and security one. The separate collection and selection of the domestic wastes may be realized also by the population in the process of their generation. But to achieve this, the population has to be made aware by the gravity of the problem linked to the waste management and the related issues of problem posed to the environment and population by the wastes.

There is selection in the district of Gorj. This selection is carried out taking into account some aspects: dimensional; from density point of view; optical; magnetic; manual.

2.3. Waste biological treatment

The elimination, the waste biological treatment respectively, relies on the decomposition of the organic substances from the wastes under the action of the microorganisms (Ahn et al., 2004; Boullagiu et al., 2004; Chae et al., 2004; Lissens et al., 2004; Mahmoud et al., 2004).

The decomposition is realized by two procedures:

- the transformation in compost through air feeding;
- the transformation in biogas through tight closing that leads to a reduction of the initial content of organic substances.

By the biological treatment are realized both the valorization and the residues removal. By the process of obliteration the wastes are converted in a non-polluting product with a high nourishing value for plants and a very good supplement for the soil physical and chemical state. The waste conversion in used compost in agriculture is known in practice from about 7-8 decades, mostly after the populated centers met with an important development.

Although until now there have been realized many researches and processing procedures, the problem of obliteration remains still actual and continues to be studied, both independent and together with other methods of waste valorization (Celis-Garcia et al., 2004; Dohanyos et al., 2004; Mahmoud et al., 2004).

Basically the compost preparation technology has two fundamental phases:

- the mechanical preparation;
- the actual obliteration.

Table 1 presents the compost composition from the composting station from the district of Gorj.

The samples for the determination of the utilization possibility in agriculture of the mud were taken from the soil surface, from 2 agro-chemically homogeneous plots, of 1 hectare each, the sampling depth being 0-20 cm, in 1 kg plastic bags, separately labeled. The soil sampling was done with the help of the Mole type agro-chemical probes.

The soil samples were passed through solution with the help of the mineralizer by oxidation with concentrated H_2SO_4 and 50% perhydrol, then the samples are analyzed by flame atomic absorption spectrometry by using a flame system AA Spectrometer novA®300.

Table 1. Average composition of compost probe from the domestic wastes prepared in the compost station or formed in the baluster for controlled storing

	The average composition of the compost%	
Characteristics	***Composting station***	***Storing baluster***
Water	35.98	34.14
pH	7.4	7.62
Dried substances		
Total organic material	45.38	41.50
Carbon	17.22	12.78
Nitrogen	0.77	1.35
Carbon/Nitrogen	18.78	9.47
Main elements		
Phosphorus Pentoxide (P_2O_5)	0.85	0.75
Potassium (K_2O)	0.78	0.64
Soda (Na_2O)	0.89	0.62
Lime (CaO)	6.67	9.80
Magnesium (MgO)	0.94	1.86
Iron (Fe)	5.54	6.45
Sulphur (S)	0.75	1.09
Chlorides (Cl)	0.66	0.90
Oligoelements (substances necessary for the microorganisms nourishment)		
Magnesium (Mg)	0.0452	0.0689
Copper (Cu)	0.0669	0.0929
Zinc (Zn)	0.0803	0.1519
Boron (B)	0.0017	0.0017

Table 2. Characterization of the soil samples - first sampling point

Parameters	***Unit***	***Source values***										***Normal Values***	***Limit Alert Values Sensitive use***
		01	02	03	04	05	06	07	08	09	10		
pH at 20°C	pH unit	8.32	7.93	8.11	8.00	8.20	8.08	7.30	8.15	8.5	7.46	-	-
Humidity	%	3.37	3.19	3.89	3.11	3.69	3.65	3.65	3.65	3.75	3.72	-	-
N-total	mg/kgSU	58.56	60.59	63.62	64.95	60.14	58.41	65.35	62.95	63.7	60.39	-	-
NO_3-N	mg/kgSU	41.68	42.59	44.42	46.35	44.34	44.51	47.65	47.46	43.7	44.19	-	-
NH_4-N	mg/kgSU	16.88	18.0	19.20	18.6	15.8	13.9	17.7	15.49	20	16.2	-	-
P_2O_5	mg/kgSU	3.814	4.181	4.47	2.62	3.09	1.42	1.38	3.32	3.90	1.14	-	-
MgO	mg/kgSU	10.779	11.40	11.52	11.77	13.03	10.96	11.12	13.68	14.61	11.64	-	-
CaO	mg/kgSU	17.411	14.921	15.068	16.49	14.75	12.77	12.615	12.31	22.82	21.66	-	-
K_2O	mg/kgSU	4.973	3.841	4.513	4.123	4.899	3.764	4.640	4.733	3.49	4.42	-	-
Cd	mg/kgSU	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1	3
Cu	mg/kgSU	17.2	20.02	16.76	16.23	14.19	16.68	18.92	17.21	15.30	18.76	20	100
Ni	mg/kgSU	27.21	25.66	24.59	23.7	22.51	23.54	25.38	23.19	28.8	27.95	20	75
Pb	mg/kgSU	15.06	14.12	14.95	13.41	12.33	14.54	13.38	14.15	14.17	14.77	20	50
Zn	mg/kgSU	36.32	36.47	32.08	29.5	25.8	25.82	29.33	26.50	25.19	30.29	100	300
Cr	mg/kgSU	32.04	33.2	37.55	37.22	31.3	37.42	31.85	31.66	30.3	34.11	30	100
Mn	mg/kgSU	374.48	378.35	403.5	416	363.9	376.8	413.17	426.8	467.7	439.1	900	1500
Hg	mg/kgSU	<0.1	<0.1	<01	<0.1	<0.1	<0.1	1	<0.1	<0.1	<0.1	0.1	1

SU – dried substance

Table 3. Characterization of the soil samples from the second sampling point

Parameters	*Unit*	*L1 01*	*L2 02*	*L3 03*	*L4 04*	*L5 05*	*L6 06*	*L7 07*	*L8 08*	*L9 09*	*L10 10*	*Normal Values*	*Limits Alert Values*
pH at 20^0C		8.39	8 29	8.01	8.30	8.27	7.57	7.68	8.36	7.66	8.09	-	-
Humidity	%	3.75	3.74	3.11	3.60	3.66	3.58	3.35	3.41	3.63	3.50	-	-
N total	mg/kgSU	52.43	45.47	49.1	52.92	45.18	48.06	46.54	49.89	49.76	48.67	-	-
N-NO_3	mg/kgSU	41.74	36.86	39.60	42.12	37.25	37.7	39.07	38,12	38.59	37.17	-	-
N-NH_4	mg/kg SU	10.69	8.61	9.5	10.80	7.93	10.36	7.47	11.77	11.17	11.5	-	-
P_2O_5	mg/kgSU	3.446	2.673	3.504	3.085	2.205	1.661	1.420	1.836	1.664	1.304	-	-
MgO	mg/kgSU	19.838	13.519	17.82	11.41	15.308	20.5	14.925	19.05	12.062	10.7	-	-
CaO	mg/kgSU	30.225	21.272	19.517	19.464	18.70	21.385	25.121	28.818	17.445	23	-	-
K_2O	mg/kgSU	3.927	4.05	3.667	3.678	3.689	3.777	4.033	3.578	4.241	4.329	-	-
Cd	mg/kgSU	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1	3
Cu	mg/kgSU	18.91	11.48	18.78	13.69	22.68	23.03	22.03	14.92	14.68	16.81	20	100
Ni	mg/kgSU	16.41	16.20	29.37	19.07	26.87	32.13	34.5	30.94	18.41	27.02	20	75
Pb	mg/kgSU	21.88	20.97	15.16	25.64	17.96	24,21	22.92	24.03	22.40	18.33	20	50
Zn	mg/kgSU	49.58	45.34	43 39	46.89	43.71	46.61	43.40	39.27	31.34	48.12	100	300
Cr	mg/kgSU	36.69	28.51	31.92	32.34	32.62	27.1	37.34	32.05	31.05	30.11	30	100
Mn	mg/kgSU	412.72	402.69	362.53	418.96	451.12	405.82	373.54	433.16	387.53	405.78	900	1500
Hg	mg/kgSU	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	1

2.4. Waste storage

Until now, both on national as well as on the global level there is the practice of the residue evacuation in the so-called 'garbage dumps'. They are formed either in natural depressions or are the result of field hosing or construction quarries. Due to the fact that the number of the garbage dumps is getting smaller and the distance to reach them is great, the waste transportation expenses are considerable.

The waste storage may be (Apostol et al., 2006; Căpățînă et al., 2006):

- simple;
- controlled.

The storehouse represents a location for the final elimination of the wastes through storage on the ground or in the underground, including:

- internal spaces for the waste storage, that is storehouses where a waste producer performs its own waste elimination (the producing site);
- a permanent arranged surface (that is, for a period of over a year) for the temporary storage of the wastes, but exclusively;
- installations where the wastes are unloaded to allow their preparation for a later transportation for the recuperation, treatment and final elimination somewhere else;
- the waste storage before its valorization or treatment for a period smaller than 3 years, as a general rule, or the storage before the elimination for a period smaller than one year.

3. Results and discussion

3.1. The possibility of using the compost as a fertilizer

For the first sampling point (Table 2), the results of the samples indicate the fact that the soil has a neutral to weak alkaline pH (7.3 - 8.5), a relatively constant humidity (3.11 - 3.89%), and the heavy metals content is under the alert limit.

The analytical results of the heavy metals in the medium soil samples lead to the following conclusions:

- cadmium and mercury are not detectable;
- nickel with concentrations of 22.5-28.8 ppm (1 mg/kg = 1 ppm) exceeds the normal values for the soil (20 ppm), but is still under the alert limit (75 ppm);
- total chromium with concentrations from 30 to 37.5 ppm exceeds the normal value of 30 ppm, but is still under the alert limit (100 ppm).

The lead, zinc, copper, manganese concentrations are under the normal limits.

In Table 3 there are presented the analytical results for the second sampling point. The results of the samples indicate the fact that the soil has a weak alkaline pH (7.57-8.4), a relatively constant humidity (3.11 -3.75%); and the heavy metals content is under the alert limit. The heavy metals concentration is not significantly different as compared to other areas:

- cadmium and mercury are not detectable;
- copper is present in a concentration between 11.48 and 23.03 ppm. Three of the medium

samples have concentrations that exceed the normal value of 20 ppm but are much below the alert limits (100 ppm).
- nickel, with concentrations from 16.2 to 34.5 ppm, often exceeds the normal value (20 ppm), but remains under the alert limit (75 ppm);
- total chromium, with concentrations between 27.1 and 37.34 ppm, for all samples, is much under the alert limit (100 ppm);
- the zinc and manganese concentrations are below normal limits.

This study made in order to establish the possibility of using the compost as a fertilizer was followed by a study based on a questionnaire for people attitude examination about environmental problems especially waste problems.

3.2. Study regarding the attitude of the population over the problematic of solid wastes in the countryside

This questionnaire was made for the examination of the individual's attitude, with the residence in the countryside, over the problem of the environment pollution with solid wastes and the lack of a waste management system. The study used a sample of 21 persons that live in the countryside. The researchers tried to understand as much as possible the way each person conceived the problem.

In the following we will present some graphics that reflect the answers of the persons interviewed regarding the issue. The age of those interviewed ranged from 18 to 58 years, the last one being the age of the retiring persons. Regarding the occupation, they qualify in the following categories: pupil, housekeeper, manager, unemployed, retired person, civil servant, worker, professor, engineer, economist, foreman, technician, electrician etc. Regarding their level of study qualification, the respondents range from those with medium studies (vocational education, high school), primary studies (7 and 8 grades) and higher studies (faculty).

Regarding the question (1): *„On a scale from 1 to 10, appreciate the importance of the environment protection for the territory arrangement in comparison with other socio-economic sectors?"* the answer is given in Fig. 1

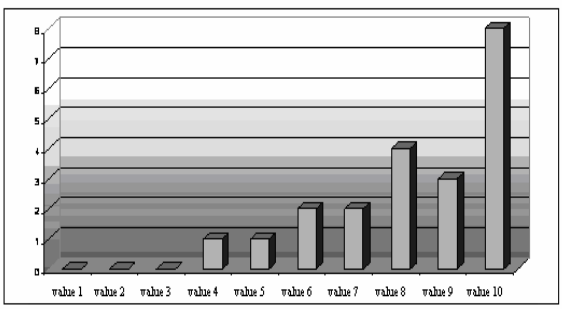

Fig. 1. Graphic representation for question No. 1

Question (2): *„How do you appreciate the quality of the environment in the countryside?"* has the answer graphically represented in Fig. 2.

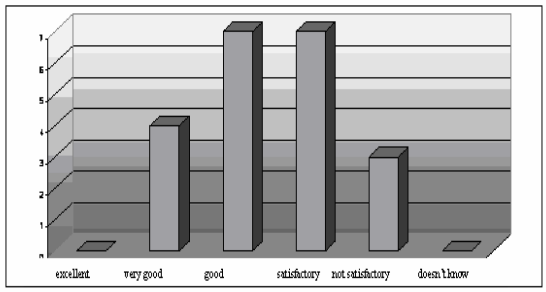

Fig. 2. Graphic representation for question No. 2

The answers given to this question are mostly positive, in the sense that the administrative territory of the commune was not covered with wastes and the condition of the environment is still favorable.

Question (3): *„Which is the most serious environment problem from the countryside?"* Through this question the research followed the knowledge of the most serious present day problem for the commune and if it is perceived at its real value for the protection of the environment (Fig. 3).

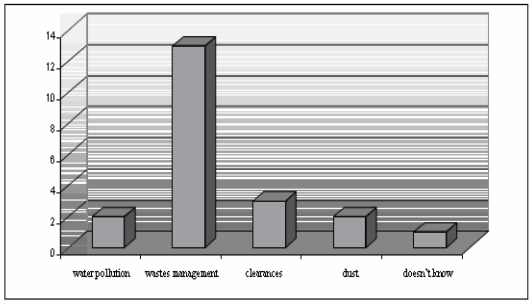

Fig. 3. Graphic representation for question No. 3

Question (4): *„How do you appreciate the countryside people behavior confronted with the environment problems?"* is answered in Fig. 4.

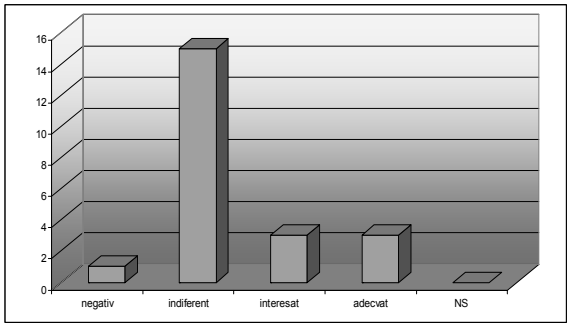

Fig. 4. Graphic representation for question No. 4

Question (5): *„How do you consider that the countryside problems should be solved?*" The

answers show that this particular problem of the waste management should be confronted together by the local communities with the local people involvement (Fig. 5).

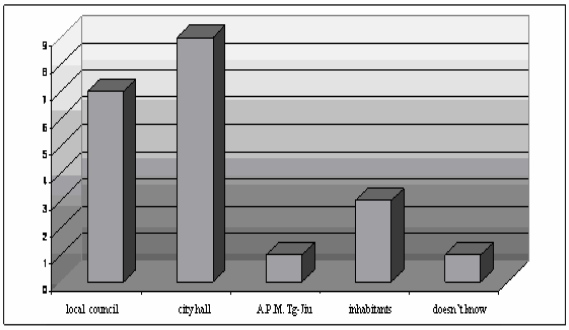

Fig. 5. Graphic representation for question No. 5

Question (6): *„How do you appreciate the outcome of the measures undertaken by the parties involved in resolving the environment problems?"* Contrary to our expectations, the answers given by the questioned reflects indifference for this problem (Fig. 6).

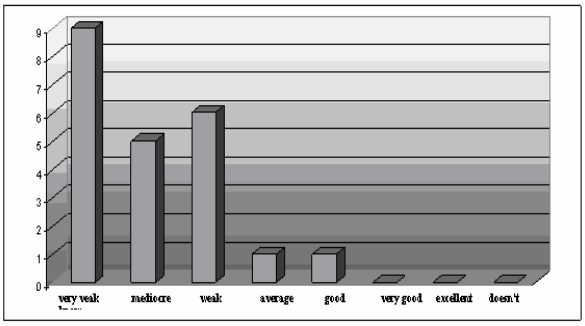

Fig. 6. Graphic representation for question No. 6

Question (7): *„What do you understand by waste management?"* has the answer presented in Fig. 7.

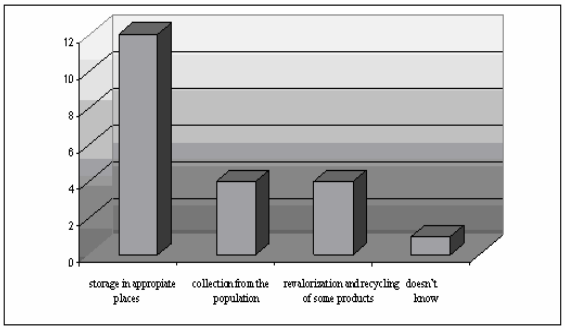

Fig. 7. Graphic representation for question No. 7

Question: *„Would you orientate yourself for the acquisition of some 'ecologic products', given the conditions that they would have higher prices than the conventional ones?"* is answered in Fig. 8.

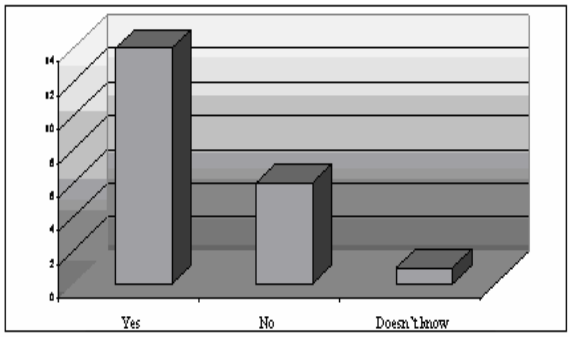

Fig. 8. Graphic representation for question No. 8

For the question (9): *„If a tax would be perceived for collecting domestic wastes within the commune would you agree with it?"* the answer is given in Fig. 9.

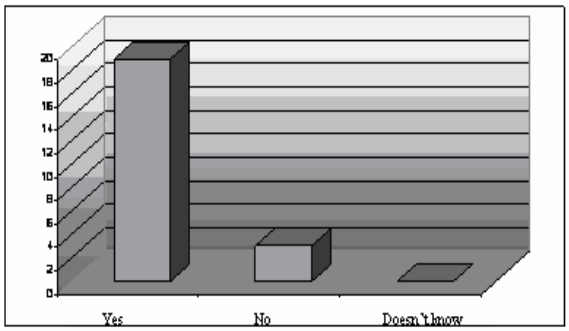

Fig. 9. Graphic representation for question No. 9

Question (10): *„Do you believe that development of your children personality requires the cultivation of an attitude regarding the protection of the environment?"* has the answer represented in Fig. 10.

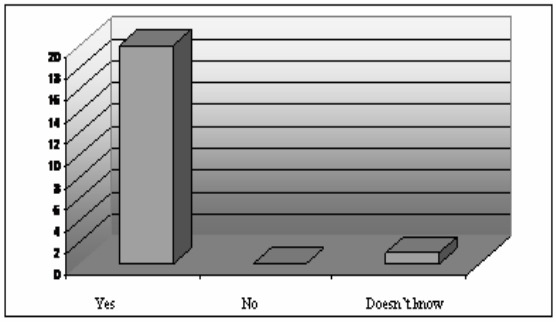

Fig. 10. Graphic representation for question No. 10

4. Conclusions

The compost improves the physicochemical characteristics of the soils and the requirements of using it as a fertilizer on the agricultural fields.

Because of the light alkaline pH and its chemical features, the soil from the district of Gorj allows the application of the compost with the condition that it has to be in a finished state (ripped)

and with the condition of respecting the dozes of applied mud and calculated on the surface unity.

The measures and methods are materialized and exposed in a clear way through an integrated concept of waste management in the countryside:

- implementing real measures for cleaning;
- coordination and ordering of cleaning measures;
- informing and counseling the waste producers in order to minimize the quantity of wastes generated as well as encouraging the valorization measures;
- imaging and issuing of some legal stipulations, considered as the most important legal basis for the waste removal, with the possibility of influencing the citizen's behavior towards a reduction of waste production mentality.

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