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Research

HOUSEHOLD AND INDUSTRIAL WASTE AS A BASIS FOR COMPLEX COMPOSTS FOR CULTIVATED LANDS

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ABSTRACT

Waste of various productions are based on their exchange between autotrophs and heterotrophs. Emergence of plants and formation of energy pathways during decomposition of organic matter and generation of gases with high participation of oxygen and nitrogen have affected the heat exchange and determined the modern atmosphere foundations. Human influence on the nature has increased the pressure on it through floods and earthquakes. Human influence on the nature is now hundreds of times higher than a hundred years ago. Irrational usage of cultivated lands enhances soil and water pollution due to the accumulation of heavy metals and oil in them.

INTRODUCTION

Generation of waste is characteristic of all productions performing creation of materials, including various options of industrial and agricultural production, man-made or natural perturbations in the development of certain ecological systems, including eco-crisis of living forms from small species to humans. Even before the emergence of humans, in the course of physical and chemical decay of certain landscapes (floods, earthquakes, volcanic explosions another phenomena occurring on earth), sludge deposits a kind of protosoil were formed first, and then followed soils with properties supporting development of various forms of ecosystems (Aleksandrova, 1980; Belyuchenko, 2013; Belyuchenko, 2015).

Stability of all living systems in the cultivated land is contingent on the consistency of circulation of elements and energy pathways between autotrophic and heterotrophic metabolic patterns. In the scheme of things, the impact of vegetation and soil is determined by mutually beneficial exchange of metabolism products between autotrophs and heterotrophs. Development of the agricultural system is accompanied by the defunct biomass mineralization and no less important process of humification through the resynthesis of the organic matters non-demanded by plant bodies in conjunction with the decaying organic matters of the decomposing biomass. The new composition of humus and organo-mineral compositions are detached from the biological cycle in the form of new soil formations and remain in it for living organisms. After some time, the main part of such elements returns to the biological cycle of the cultivated land, and only a small part passes to the geological system of interactions due to a certain necessity (Belyuchenko, 2011; Belyuchenko, 2015a; Belyuchenko, 2015b).

Destruction of rock formation minerals allowed forming riverbeds and other aqueous systems, and facilitated formation of basinal landscapes with various forms of water exchange at the different plots of land, facilitated plant emergence and, as a consequence, formation of energy pathways in decomposition of organic matter and a range of gases which enabled generation of the new atmosphere containing CO_2, NH_3, N_2, with a high participation of nitrogen and oxygen in it which significantly changed gas exchange and heat exchange. In other words, various changes in the development of cultivated lands systems were accompanied by noticeable variation of composition and structure of waste generated: at first, homotypic mineral, and

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then organic polytypic organo-mineral, characterized by various peculiarities and new ecological niches.

The emergence of humans and development of their large population has significantly changed the quantity and quality of waste in the landscape system's composition. Human pressure on nature has now significantly surpassed the influence of natural phenomena floods, fires, earthquakes, etc. Nature has worked out stability and flexibility, recover capacities of ecosystems in general and its biota in particular over the thousands of years. An example of this can be the destruction of environmental conditions by humans, and in case of their abandonment intact further on, quite fast recovery of various landscape systems is registered, as well as their integrated development continues. For instance, the recovery of Chernobyl natural systems, vast woodlands, aqueous systems, renewal of meadows and woods after the vanishing of villages, settlements, termination of agricultural farming rotation, etc. This shows that nature still can mobilize its capacities and is capable of self-restoration in a very short period of time.

RESULTS AND DISCUSSION

Malfunction of landscape agricultural systems touches upon many sides of development, including vegetation, micro- and mesofauna, mushrooms, and bacteria, the abundance of soil biota in general, as well as the water regime of certain basins, the change in reaction of soil solution, the formation and transformation of organic matter and humus, the development of erosion processes, the soil texture and the capacity of their genetic horizons, the amount and composition of absorbed bases, the cation exchange capacity, the degree of base saturation, etc. There are changes in numerous parameters of the status of soil and living organisms, water and air, and other conditions in cultivated lands systems development (Dobrovolsky and Nikitin, 2000; Belyuchenko, 2005).

Such a wide difference in malfunction of cultivated lands systems often causes a dropout of certain species of wood, kinds of herblike taxons, and formation of the new vegetative systems. In other words, over millions of years, the exosphere has accumulated a huge reserve of energy, which is able to provide a high stability and form new systems with new capabilities in the development in different direction depending on the degree of malfunction of their physical, chemical, energetic and biological capabilities to re-create and maintain the ability to develop own energetics and keep performing circulation of elements and matters in the framework of the entire biological and geological forms of its development.

The agricultural use of soils for a long period of time has conditioned a distinct loss of their resources and has set a task of their functional control in order to enhance plants' productivity on the one hand, and increase the soil tolerance to the impact of natural and man-made factors. Reasonable management of the soil functioning mechanisms allows determining and solving issues of natural resource management and environment protection (Dobrovolsky and Nikitin, 2012).

The concept of soil as the major component of the ecosystem in general was specified by MSU professor (Kovda, 1971). The motto of the 10th world congress of soil science headed by (Kovda, 1985) was: "soil is a biosphere component". Eminent soil scientists, MSU professors (Dobrovolsky and Nikitin, 2012) substantiated the soil multifunctionality and estimated the doctrine of its functions as an ecological foundation of the ecosphere. Soil, in their opinion, is a system of living heterotrophic organisms using the defunct biomass of plants, animals, and microorganisms and providing all living organisms with elements of mineral nutrition (Dobrovolsky and Nikitin, 2000; Dobrovolsky and Nikitin, 2012).

Commitment of soils to heavy yield is a cause of its degradation. For agricolists, the return of NPK to the soil deflects attention away from disorders of the content of other elements, the lack or excess of which causes noticeable changes in the product quality. Therefore, it is agricultural technology that is the basic cause of soil degradation, as its plowing enhances mineralization of the organic matter and biological activity of living organisms. The monoculture of main plants takes up from 1% to 20% of mineral matters excreted by soil during plowing; the other part (upto 10% to 15%) is preserved in the process of humification during interaction with organic matters; the third part, due to its mobility, is washed to the drains of various water bodies; and the fourth part suffers water and wind erosion, taking aleurite including main biogenic substances out of soil (Belyuchenko, 2014; Belyuchenko, 2015a; Belyuchenko, 2015b).

Environmental protection measures carried out separately do not solve the issue of soil protection. Soil is formed in the geological timing aspect, while living organisms, including higher plants, form in the real-time version of their life activity. Basically, plants and soil can be estimated within a comparative timing aspect, although their development rate will differ quite significantly, taking into account the peculiarities of soil autotrophs and heterotrophs' metabolism, as well as ground components.

In 1970s, Soviet soil scientists (Sokolov and Torgulyan, 1976) detached two temporal independent objects in the soil profile: "soil-memory" and "soil-moment". There is no similar division for plants, and botanists use such indicators in the scale of decades and even centuries. Soil scientists do not use this division. Phytocoenosis takes into account species composition, the abundance of species populations, superterranean and subterranean phytomass, phenological spectra, the mass of annual gain and drop (Sokolov and Torgulyan, 1976; Belyuchenko, 2005; Dobrovolsky and Nikitin, 2012).

The capacity of genetic horizons, their coloration, granulometric texture, structure, presence of roots and other inclusions, content and composition of humus, amount and composition of absorbed bases, pH, Eh, water extract, iron according to (Mehra and Jackson, 1960) cation exchange capacity, degree of saturation, hydrolytic acidity, bulk composition, mineral composition, biological activity, CO_2 emission, composition and abundance of soil biota, and fermentation activity are estimated in soil. The capacity of genetic horizons and humus reserves in them are preserved for centuries, although the mass of each indicator renovates: the deeper the soil is, the longer its renovation continues. Comprehensive assessment of cultivated land study allows bringing into step the functioning mechanisms of certain components of the system through the real possibility to control specific mechanisms and regulate environment factors (Belyuchenko, 2005).

Human influence on the nature is now hundreds of times higher than a thousand years ago. As for soil conditions, the prospective of desertisation of really vast land territories, woodlands exposed to fires and emissions from industrial enterprises are increasing. This fact disturbs biospheric processes through the amplification of impact by technological means (ships, planes, combines, agrimotors, extraction of minerals, etc.), emission of reactive gases into the atmosphere, input of solid domestic and industrial waste to soil, aqueous systems, air, etc.

Natural systems, which have accumulated a variety of contaminants, will be able to be improved through the creation and use of complex composts including up to 10 or more kinds of waste of various origin. By the complex compost, we mean the new direction in practical ecology and agriculture based on the creation of complex mixtures of various household waste, industrial and agricultural production waste, as well as natural formations for soils enrichment with organic and mineral disperse and colloidal systems in order to improve their physical, chemical, biological, and environmental functions that can be the basis for the development of new ecological niches, formation of new, less aggressive consortia, as well as expansion of the species diversity of living organisms (Belyuchenko and Mustafaev, 2013; Belyuchenko, 2015).

An ecological niche essentially means the needs of a species, population, or sort type in the cultivated land system, including their position in space and functional role in the food chain. Reclamation of available space of the ecological niche by crop in the cultivated land manifests poorly due to the limitation of their development time (usually up to one year) and their weak vegetative mobility determined by the specific activity of tillering zone. It is necessary to develop crop growing technologies with transition to the two-tiered system sowing and harvest capable of full reclamation of the entire capacity of ecological niches in the cultivated land by the cultivated crops (Belyuchenko, 2005).

Ecological niches are detached according to the main environment factor necessary for the functioning of the specific sort type, including their ties with weed plants, pests and diseases. Introduction of mixed varieties of certain crops differing by their requirements to food and water resources with due regard to selection and sowing in the mix of different crops not serving as antagonists and using various resource factors for their development will facilitate the efficient use of edaphotop in the cultivated land.

Species of any biological system (mixed variety, sort type) adapt to changing conditions of environment during the whole process of development (from germination to formation of a new crop), including technological processes (plowing, chemical treatment, fertilizers, heavy metals pollution, etc.) significantly changing ecology of organisms, especially their inner peculiarities chemical compound, anatomy, and physiology of certain tissues. External specific peculiarities of living organism's sizes and forms of leaves, roots, stems, and inflorescences also suffer in excess of contaminants in all landscape compounds. Losses in soil fertility within insignificant fluctuations of certain factors are not manifested visibly. The development of crops is affected by the lack of nutritional substances in the topsoil, primarily, the carbon deficit: when certain external conditions (moist, light, temperature) are unfavorable, physiological (aggregate) stress develops in decrease of synthesis, especially, of quality protein (Belyuchenko, 2005).

Distribution of usual complex compost under the main development on ordinary chernozem with mass from 65 t/ha to 70 t/ha with addition of minimal doses of mineral feedings will facilitate the diversity

of ecological niches, which will provide optimal satisfaction of needs in nutritional substances of even the most demanding food and industrial crops (corn, sugarbeet, etc.). This direction, the basis of which includes organic substances of all origins and mineral elements of phosphogypsum as an important source of the food resource factor in minimization of mineral fertilizers distribution, can take quite an important place in applied research. A combination of organic (semi-decomposed cattle, swine, and poultry dung, one-year household waste, etc.) and mineral (phosphogypsum, potassium production waste, etc.) substantively affects compounds reprofiling. Adding phosphogypsum and organic substances significantly affects the husbandry of organic fertilizers and no less important compound-ammonia nitrogen, the binding of 1 kg of which, according to our calculations, consumes from 8.0 kg to 8.2 kg of phosphogypsum. Calcium sulfate $CaSO_4 \cdot 2H_2O$ of phosphogypsum binds evolving ammonia (NH_3) into ammonium sulfate, which increases the cost of this valuable fertilizer on useful crop yield (Belyuchenko, 2013; Belyuchenko, 2014; Belyuchenko, 2015).

An analysis of technologies of modern agriculture has shown that cultivation of crops in the territory's environment should currently take into account the specificity of the ecological niches not only of the individual fields, but also of their plots, as well as the ecological peculiarities of crops. An important direction in the development of diverse ecological niches is to develop mixed variety crops of major kinds, as well as mixed crops of ecologically different taxons.

An important direction of maintenance of high productivity of crops is the system of fertilizers of each field and its individual parts based on a realistic assessment of soil fertility, use of organic and mineral fertilizers contributing in increasing the diversity of ecological niches on the main factor-food resources and moisture supply. In other words, the modern technology of optimization of the functioning of cultivated lands should be based on a serious study of the characteristics of ecological niches formation and the basic techniques of growing crops in adding complex composts at intervals of 5 to 6 years (Belyuchenko and Muravyov, 2007; Muravyov and Belyuchenko, 2008).

The second direction of maintenance of high crop productivity in cultivated lands is the effect of adding complex composts on the study of consortive connections in the development of a complex mixture consisting of ecologically diverse crops, where consortia of various kinds of insects, fungi, bacteria, and other organisms are formed**.** The latter may vary considerably by their metabolites gaseous and liquid which do not always find the consumers among the cultivated land inhabitants. Therefore, along with the improvement of the soil environment through adding complex composts, the weakening of the competitive aspects between the organisms in the subterranean and superterranean parts of the crops has a certain relation through their differences in the evolving of gas and liquid formulations.

A very important part of the functioning of cultivated lands is the participation of the third component-forest strips. Unfortunately, the importance of forest strips still is insufficiently assessed in the overall system of cultivated land, although their value is very high. Problems of forest strips, unfortunately, are not currently explored, and, in fact, the interest of expert ecologists and agrarians in this issue has significantly weakened (Dobrovolsky and Nikitin, 2000; Dobrovolsky and Nikitin, 2012).

The ecological situations in some areas of our region are the result of poor environmental management due to the increased chemical and mechanical pressure on the environment, use of outdated technology, accumulation of industrial waste, pollution of soil and water systems with heavy metals and oil, which has affected the productivity and quality of agricultural products. Therefore, our task consists in the development of technologies and their testing in the transfer of various industries to the recyclable materials to produce complex composts, which represent a valuable complex organo-mineral fertilizer (Belyuchenko, 2013).

CONCLUSION

In general, issues of accumulation of industrial and agricultural waste occupying large areas disturb many people today, but few are solved practically: the problem of using domestic waste in municipal landfills is not being solved, and the accumulation of oil, heavy metals, and other pollutants in soil actively reduces the yield and its quality. The development of agriculture at the present level requires training high-level specialists with deep environmental background to solve problems in a new professional level taking into account commercial and economic tasks. Due to the necessity of training experts with good environmental background, it is necessary to improve the highest ecological and technological education and interdisciplinary training of environmentalists-researchers and environmentalists-technologists, experts in the field of waste disposal able to solve practical tasks in

accordance with the environmental requirements and the environment status. Any production task must be subject to environmental protection and far-sighted use of resources based on a profound understanding of the links around the world.

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