# Complex valorization of two waste biomasses as biosolid nutrient composite for improving soils quality

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This paper present a study regarding the complex valorization of two waste biomasses resources consisting of a residue marine biomass along Romanian Black Sea Coast - an unusually large amount in summer of algae and zoobenthos biomass and the other waste biomass as sewage sludge from wastewater treatment plants.
The valorization of these two biological wastes was conceived as a result of theirs nutritional potential for Dobroudja degraded soil, Romania and as complex capitalization of these biomasses. It was establish the biotechnological process to an innovative biosolid nutrient composite obtaining.

Soils in Dobroudja, besides the fact that have been extensively exploited in past 50 years, they facing now with climate change (acute and longer periods of drought) and pollution, which has resulted in accelerated and intense erosion processes. The follows main processes have contributed to soil degradations: erosion, agriculture overexploitation, chemical fertilizers treatments (nitrogen fertilizers; phosphorous fertilizers; potassium fertilizers; complex fertilizers; microelements fertilizers), decrease of organic matter content, contamination, salinization, compacting, loss of soil biodiversity, removal from agriculture circuit, landslides and floods. In Dobroudja due to various environmental conditions are encountered several types of soils among chernozem and white soils have important share, characterized as soils that in natural conditions have physical-chemical and biological characteristics favorable to all crops (Paltineanu *et al*., 2000).

Agrochemical mapping results emphasize obvious decrease in humus content and nutrients. Approximately 80-90% of the mapped area has a medium and low assurance with nitrogen and phosphorus and dominant good potassium insurance. The climate is temperate-continental, mean annual temperature varying from 10°C to 11.7°C and average annual rainfall between 300-400 mm. Experiments were carried out on common land in the Northern part of Constanta County, Romania, where desertification phenomenon is intense (Lacatusu *et al*., 2008).

The obtaining process of the new solid biofertilizer is based on conditioning operations and presents a fertilization complexity through its specific composition of organic compounds (proteins, lipids, carotenoids), nutrients (nitrogen, phosphorous), mineral salts and microelements, necessary for soil and plants nutrition (iron, manganese, copper, zinc), from natural wastes, marine residual biomass and sewage sludge (Negreanu-Pirjol *et al.*, 2011).

Obtaining the new solid biofertilizer in six variants, from marine algae biomass 0.1% - 90% (percent biomass), marine zoobenthos biomass 0.1% - 80% and sewage sludge from wastewater treatment plants 0.1% - 90%, involved the following steps: the algae and zoobenthos marine biomass were conditioned by dehydration, at ambient temperature, for 72 hours; the sewage sludge has been conditioned by drying at room temperature for 72 hours, then was dried in an oven, stepped up to a temperature of 50°C; components were subjected to breakage and grinding separately, sprayed with a grinding machine and sieved through a sieve with mesh diameter of 90 µm; the final mixture obtained being homogenization; potentiometric *p*H of each variant was determined, resulting values ranging 7.09-7.89; it was wetted with distilled water, then left to macerate for 24 hours at room temperature. The solid product was passed through the meshes of a sieve with diameter of 1.25 µm, when non-uniform grains were obtained, who were subjected to the drying process, the oven at 50°C. Circular shaped granules were obtained, whose color intensity was correlated to the mineral charcoal content (dark brown to gray-black), Figure 1.


Figure 1. New solid biofertilizer variants

Regarding the biochemical and physical-chemical parameters of the sewage sludge used as raw material for biosolid fertlizer obtaining, an increased organic charge compared with the inorganic compounds, a highest value of total organic nitrogen and a valuable *p*H limits, were registered. Also, regarding the nutrients concentrations values, it could be noticed that the new biosolid fertilizer contains organic matter and valuable nutritive elements (N, P), which could be contributed to the enhancement of the soils (Negreanu-Pirjol *et al.*, 2011).

Compared with other European countries sludge, the investigated active sludge is suitable for application in agriculture and the new biosolid fertilizer presented a microbial charge in Total Coliforms (TC), Fecal Coliforms (FC) as microbiological indicators, with low risk and no contamination with enteric pathogenic agents (WRC, 1997, Spinosa L., 2004).

This new biosolid nutrient composite used an innovative environmental non-conventional technology for agriculture, in relation to the benefits of marine waters protection. Through the biotechnology applied, the biosolid will keep some of the two biological wastes (sludge and algae) qualities. Also, the sewage sludge storage problem could be resolved and the sludge quality improvement by ecological sanitization methods for Gram positive and Gram negative bacteria, yeasts, protozoans, will be achieved.

The mixture with the residual marine biomass will supplement the sludge with valuable nutrients for the future improvement, while now in Romania, for wastewater and sludge treatment, only chlorination procedure is used. The biotechnological process for obtaining the biosolid fertilizer, presents the following advantages: it leverages two sources of pollution waste: biomass of marine algae and zoobentos and sewage sludge; obtain an organic fertilizer used in agriculture, horticulture, forestry, soil erosion and restoration of degraded soils; use as raw materials, organic waste easily accessible, with minimal costs for their collection, which gives a low-priced end biofertilizer product.

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