TREATMENT PROCEDURE FOR TANNERIES SLUDGE

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The paper refers to biochemical treatment and enrichment of sludge from tannery wastewater treatment for use in agriculture as fertilizer to grow crop plants and enhancer for conditioning or remediation of degraded soils. Sludge resulted from treatment of wastewater from leather processing contains: organic and inorganic substances and elements such as nitrogen, calcium, sulphur, iron, sodium, etc. In order for the sludge resulted from purification of wastewaters from tanneries to be used as fertilizer in agriculture, it must not contain trivalent chromium. Therefore, this paper presents a procedure of purifying residual floats in the leather tanning phase. Thus, the content of trivalent chromium ions is reduced from 4.5-7g/l to 0.01-0.2 g/l solution from leather tanning. In the final sludge from tannery wastewater purification, the content of trivalent chromium is very much diluted, reaching values below the limit imposed by national and international standards. The development of a technological scheme for obtaining sludge to be used in agriculture is based on the following processes: sludge neutralization and dehydration; sterilization; biochemical treatment and sludge enrichment from treatment with elements necessary for plant growth and bioremediation of soil.

Keywords: sludge, wastewaters, tannery, polymers, soil.

INTRODUCTION

The project presents the application of innovative technologies of capitalizing sludge resulting from purification of wastewaters from tanneries in agriculture – as biofertilizer for plants and soil conditioning agent for degraded or contaminated soils, with the main objective of obtaining complex products – from sludge resulting from purifying wastewaters from tanneries.

The leather industry discharges from tanneries polluted industrial waters difficult to treat. Currently, in our country, depollution technologies in tanneries are based on the classic chemical procedure of treating with high consumption of reagents, resulting large quantities of sludge. This sludge cannot be used in agriculture as fertilizer due to its trivalent chromium content. This paper presents a method of purifying wastewaters from tanneries, the trivalent chromium obtained from purified solutions being recycled in the leather industry and as additive to mortar in constructions.

The sludge resulting from purifying wastewaters from leather processing contains: organic, inorganic substances and elements such as: nitrogen, calcium, sulphur, sodium etc.

EXPERIMENTAL

Elaborating the technological diagram of obtaining sludge which can be used in agriculture is based on the following processes:
✓ sludge neutralization;
✓ dehydration and sterilization;
✓ biochemical treatment and enhancement of sludge from purification with elements necessary to plant growth and bioremediation of soil.

Neutralization is accomplished by means of a neutralizing agent. Calcium hydroxide is particularly advantageous, available as whitewash or it can be obtained by dilution of lime in water. For dehydration – water removal from tannery sludge – it is necessary to add substances that increase the sedimentation rate of flakes. In this sense, a precipitant is used – polyelectrolyte based on high molecular weight polyacrylamide. Polyelectrolytes contain groups that are reactive in aqueous solution and have a strong affinity for the surface of colloids in suspension or toward very fine particles in the aqueous suspension or sludge. Polyelectrolytes compounds act according to their ionic structure, to the interactions between them and solid particles, interactions based on the formation of hydrogen bonds (as in non-ionic polymers) or electrostatic interactions, causing a destabilization on the particle surface (as in anionic – negative charge, or cationic – positive charge). Destabilization and coagulation of a very large number of single particles lead to the formation of large flakes, which are easily separable from the suspension. Praestol organic polymer produced by Stokhausen Germany is a high molecular weight synthetic flake.

Figure 1. Industrial installation (12-14m³) of residual float exhaustion from leather tanning

Biochemical treatment consists in processing sludge with a set of enzymes, coenzymes and natural enhancers with “starter” liquids, which modify the toxic reactions of sludge with a corresponding elimination of emissions of hydrogen sulphide, mercaptans, ammonia odours and other specific odours.
The technological process utilized a commercial product made in Switzerland. This product contains 2 types of bacterial cultures: Aspergillus Orizae and Bacillus Thuringgensis. Bacterial cultures produced by “selected spontaneous culture” are not pathogenic, salmonella-free and harmless to humans, animals or fish. This product contains: lipase 30,000 MWV; amylase 1,200 units/g, cellulase 900 units/g and protease 10,000 units/g.

In order to enrich using the elements necessary for plant growth and soil bioremediation, it was used with very good results (potassium phosphate). This contributes both to pH adjustment and to improving the nutritional properties through the addition of phosphorus and potassium needed for plant growth and development.

Determinations were made both in terms of physical condition (structural hydrostability, state of compactness, aeration, permeability) and chemical condition (reaction, main macronutrient content and heavy metal concentration) of soil materials in which large amounts of tannery sludge have been incorporated, and in terms of quantitative and qualitative assessment of crops produced, performed at the end of the growing season.

Plant requirements in terms of nutrient elements vary greatly, causing different reactions to the application of biofertilizers.

Plants selected for checking the influence of treated sludge (NTZ) on energy and germination are: sunflower, mustard, red beet, corn, wheat, barley and peas.

**Sunflower**

**Wheat**
By applying organic polymer biofertilizers (NTZ in a dose of 25 g/kg and 10 g/kg), the aim is to stimulate metabolic processes both during germination and after seed germination.

Complex, physical and chemical protection treatments of seeds, for the purpose of adjustment of water penetration into the seeds, of correlating this process with the temperature and prevention of “incubation” and of stimulating the processes of germination and seedling growth may be of practical interest in that they allow early seeding, rapid germination of seeds when the necessary physical conditions are met in the soil, mass spring deep rooting and vigorous plant development, which better exploit vegetation factors and conditions.

Sunflower seeds, beet, corn, wheat, barley and peas showed a very good germination in a dose of 10 g/kg soil, higher than in the dose of 25 g/kg soil, but NTZ had a positive influence on seed germination in both doses, compared with the untreated variant.

Mustard seedlings have a very good germination in the version where NTZ biofertilizer was applied in a dose of 25 g/kg soil, but in the dose of 10g/kg soil also, mustard seed germination was higher compared with untreated seed germination.

On sandy soils, light and warm, biofertilizers are incorporated deeper into the soil (15 to 18 cm depth), where moisture is sufficient for their complete mineralization, having the role of cementing soil particles.

On clayish soils, heavy and cold, and on the loamy and tight ones, fertilization by incorporation at the surface is indicated (5 to 10 cm) having the role of heating and loosening the soil, increasing microbiological activity and restoring soil structure.

On podzols, soils with low fertility, poor in humus and organic matter, the application of biofertilizers is the main source of increasing fertility.

The crops obtained from the land where biofertilizer was applied are organic, the food chain is ecologic, and there is maximum productivity.
CONCLUSIONS

The process contributes to both remediating poor and degraded soils in agriculture, and to reduction of environmental pollution by capitalizing sludge which is currently dumped in landfills.

In addition to the favorable ecologic impact, the innovative technologies elaborated will have an impact on the rationalization of water, energy and raw material resource consumption, contributing to setting premises for application of the system of environment management.

Sunflower, beetroot, corn, wheat and pea seeds have presented very good germination in a dose of 10 g/kg soil, better than in a dose of 25g/kg soil, but in both doses, NTZ had a positive influence on germination of seeds as compared to the untreated variant.

Under experimental conditions, it can be said that incorporating large quantities of tannery sludge into the soil has had direct benefic effects on water permeability and the values of saturated hydraulic conductivity have been very high.

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REFERENCES
