Biotechnical use of the fraction organic of urban residuals, SAN LUIS

Argentina

Good Practice

1998 Submission

Categories: Technology, Tools and Methods:
- appropriate technologies

Environmental Management:
- ecological sustainability
- environmentally sound technologies

Level of Activity: City/Town

Ecosystem: Tropical/Sub-Tropical

Summary

BIOTECHNOLOGICAL USE OF THE ORGANIC FRACTION OF URBAN WASTE
This project aims at satisfying a growing demand: to solve the problem of the final disposition of the urban solid waste, by means of the recycling of the inerts that have some value in the market, and the transformation of the biodegradable organic matter into a ORGANIC BIOLOGICAL FERTILIZER, and thus eliminating the complex problem of environmental pollution and allowing the clean inert materials to recycle.
The main purpose is to solve the final disposition of the urban solid garbage in San Luis' Municipality - ARGENTINA - and the surrounding areas.
THEORETICAL BASIS.
Although a floor has potentially the necessary elements for the plants, its readiness can be too low. However, specialized micro-organisms stand out inside the micro-flora; they control micro-ecological chains by means of biolixiviating the elements of the insoluble minerals and the a symbiotic fixation of atmospheric nitrogen.
These micro-organisms require organic matter as an energy source and of structural carbon that should gather special characteristics. This structural carbon is not very easily degradable since it drives to anaerobiosis, nor very difficulty degradable as it conducts to the recycling of elements. It is convenient to incorporate an organic matter with an intermediate assimilation speed to the soil.
RESULTS
Successful experiences were carried out in pilot scale.

Narrative

TECHNICAL ASPECTS
It is a project in which the main objective is to solve the problem of final disposition of urban solid waste in the Municipality of San Luis-Argentina and surrounding areas, by means of the application of an original method of biotransforming the organic material into a recyclable Organic Biological Fertiliser, previously selecting of the inert materials to recycle. The organic matter is to blame for the

poor recovering of the inert material in our region because it complicates the recycling operations and processes of having recycled and dispersed organic pollutants. The continuous growth of this problem impacts in the quality of the urban inhabitants' life, while its return to the floors that gave him origin would contribute to maintain its fertility without deterioration of natural resources and goods, like superficial and underground waters, floors and air, and avoiding the proliferation of rodents, other plagues and vectors of illnesses.
They have intended different methods for the partial or total elimination of the residuals, among them:
Landfills to open sky (not recommendable)
-thermic destruction or incineration
Controlled discharge or sanitary filler (different types)
-production of bio-gas.
From our point of view, these are not satisfactory enough as for their effectiveness and/or profitability, because in the best in the cases they make a very partial use of the waste. Those that finish in the " compost " production are the only ones that get that point, transforming the organic matter in a physical enhancer of soils; in other words: a conditioner. This procedure has also very lingering period of transformation: 90-270 days which forces to accumulate much material in process, and consequently, elevating the costs. Generally, this transformation is of aleatory results and it wastes biologically valuable material.
We INTENDED:
- To solve the problem of environmental contamination.
- To reduce the accumulation of biodegradable organic matter to not more than 22 days.
- Not to generate bad smells, neither proliferation of rodents, flies, etc.
- To recover nutrients extracted from fertile lands, so that they return to them, and sources of carbon profitable for, especially, micro-organisms biolixiviating and nitrogen fixers.
- To use facilities re- utilizable (made of concrete)
- To achieve efficiency in the process and
standardization in the results.
- Flexible technology that can adapt to the different
regions with different climatic , economic and socio-cultural problematics.

BIOLOGICAL ORGANIC FERTILIZER

FOUNDATION
In spite of the well-known activity of the microorganisms in the soil, it is still discussed today the role and the importance of this in the growth of the superior plants. In our focus we consider that in the soil exists a microflora interrelated to its different populations as well as the environment. In this they are mineral insoluble that possess in their structure, elements
indispensable for the life of the vegetables and whose extraction is taken to end by some constituent populations of the microecosistema. These are formed, basically, by microorganisms heterotrofos, that contrary to the superior plants, they need organic carbon to live. The appropriate constitution and activity of the microecosistema, are the one that provides plants the required nutrients, extracted from the minerals insoluble present and from the nitrogen of the air.
The plants adjust their growth to the elements that are liberated from the insoluble minerals, as a consequence of the ecological interactions among all the populations. Nevertheless, many soils have lost their fertility for low readiness of these elements, due to agricultural activities that distort the microecosistema, notwithstanding that potentially they were all present.
Now then, if in order to increase the yield of the crops, it is inappropriately used a chemical fertilizer that incorporates the above mentioned elements in soluble form, it is favored the growth of microbial populations unable to carry out bioextractions or fixation of atmospheric nitrogen, in detriment of the populations that do this. As a consequence, initially you can favor the yield of the crops, but the damage caused by the distortion of the ecosystem will manifest in the future dramatically; for example, the concomitant salinization of the soil, with the corresponding lost of the water activity, causing of " hydric stress." That is to say, the degradation of the same one.
When analyzing the characteristics that the organic matter should gather to be incorporated to the soil, in order to activate the appropriate microbial populations, we checked that if organic substances difficult to degrade are added, a speed of these populations' growth is not possible to impel them to

bioextract elements and to fix nitrogen, because they have enough with recycling the present, not attacking the source mineral, insoluble.
On the contrary, the addition of quickly biodegradable organic substances, leads to a growth in initially explosive surface that for under it generates conditions anaerobicas due to insufficient oxygenation. These conditions allow the anaerobios development that begins acidifying and then waterproofing the soil to condition a habitat favorable. On the other hand, the proliferation of the anaerobic microflora is slow, and it is enough for that microflora to recycle the vital elements present, without necessity of attacking minerals, leaving little surplus for the plants, also giving nitrogen to the atmosphere.
For that expressed, it is convenient to incorporate to the soil an organic matter which speed of assimilation is intermediate, with low concentration in solubles, that induce percolation, especially ions and fulvic acids, that favors the retention of water, and that acts as a regulator in the supply of nutritious to the plants, that is carrier of microbial floras with capacity of hidrolizing organic polymers, that extracts elements and to fix nitrogen. Moreover, it should favor a good structure of the soil (texture) and preserve it of the degradation.
OBTAINING
The biological organic fertilizer can be obtained using as raw material the organic degradable fraction of the urban waste. The used microflora should possess great capacity for hidrolizar polymers and to extract strongly bound elements to insoluble structures. Inoculated appropriately and driving the process in a specially designed environment (reactor) to allow an appropriate control of operative variables, especially, temperature, humidity, pH, aeration and also microbial and biochemical.
It is important the process for the obtaining of the inoculo.
Starting from pre-inoculos constituted by microorganisms selected by their
capacities to degrade polymers and specifics
for mineral biolixiviating and to fix
atmospheric nitrogen, be also efficient and speedy in
to take advantage of organic matter, even difficult of
to degrade.
This organic biological fertilizer has
appreciable contents in nitrogen, phosphor,
potassium, magnesium, calcium, iron, zinc, copper,
sulfurate, sulphur, and so on. However, what it really cares is the
microflora that when being perfectly adapted to
the source of carbon in which it has been developed, and being incorporated to the soil, has advantages on the populations autochthonous present, to continue with its proliferation. On the contrary, they would not be successful in their competition and quickly they would be
eliminated, like what happens with the populations of the microbiological fertilizers, rehearsed certainly in other countries, in such a way that the pointed condition is completed, the organic matter should be had
become the necessary extension for
to take it to an assimilability state that assures, once incorporated to the soil, a speed of the microbial populations' growth
that favor the biolixiviations and
nitrogen fixation.
The used microbial pool respects the rules
of natural degradation (ecological) and possibly
ends up being a good tool to try to recover soils that are partially
degraded, because the so-called green fertilizers,
contribute in that sense and they have a principle
of action similar to the organic biological fertilizer, unless those are liberated to those climatic vicissitudes
in the first steps of its
biotransformation in the soil and this would make them lose efficiency in the use of the biomass. On the other hand the "compost " has also had an aleatory process, especially as for their biotransformation and to the
flora microbial companion with times of
processes that can arrive to six or nine months,

with the space demand and cost that this
means.
It is of standing out that when having valorized the organic matter, unnecessary losses should be avoided. There are investigations carrying out about
equivalent biotransformings for agroindustrial waste, for example, of tobacco,
citric, straws , green corn husk, and old broom.
PILOT PROVES. -
One carries out a test in the city of Rivadavia -
Mendoza-Argentina, with a group of young
environmentalists, neighbors and local councilmen.
The experience was carried out in galpones. After of the separation of inert and during the shattering of the organic material (three centimeters or less) you incorporates the inoculate (10% p/p). This was prepared in similar form, but with the preinoculo obtained in laboratory.
E1 process was completed in eleven days, to a temperature of around 40 C of maxim. The records were taken by means of the determination of parameters like temperature, humidity, pH, microbial populations' prevalence and efficiency of the microecosystem in the auto-control of the patogens and parasites more significant.
ENGINEERING OF THE PROJECT.
To see diagram of flow (fig.Nro 1)

GATHERING OF THE GARBAGE. -
The gathering should complete the requirements demanded by laws and protection regulations to the environment.
The separation tames in different items, it does not contribute a very significant advantage for this technology and
on the other hand it requires of important modifications of the population's behavior and of adaptations homelike many times difficult to implement. The use of operatives for the selection and manual classification of inert, is work source for non qualified manpower, efficiency non reachable for machinery.
CONSTRUCTIONS. -
The selection plant uses an optimized technology, keeping in mind labor conditions, of security and hygiene.

CONSTRUCTION OF CRADLES OR GUTTERS. -
The cradles, built in concrete, constitute and reactor of the biotransformation process. Their solidity allows a low paying-off cost and its dimensions are adjusted to the technological and biotechnical requirements.
CUT TRAVERSE OF A DOUBLE CRADLE
To see diagram (fig. Number 2)
To see diagram in perspective (diag. N? 3)
SUPERIOR SIGHT
Disposition of the cradles in the land, lagoon of oxidation and recycled of liquids and muds and selection plant.
To see diagrams (Figs.4 and 5)

Quantity of gutters. -
Minimum :120.000 inhabitants' hypothesis:
8 double gutters, of 90 meters of longitude that occupy, with roads, 5.500 m2 or 0,550 have. (to see diagram Number 4)
Hypothesis of maxim :210.000 inhabitants
14 double gutters, of 90 meters that occupy an extension of 9.180 m2 or 0,918 with corridors have (to see diagram Number 5)
The lagoon of oxidation, it should be designed according to the configuration of the land, slopes, vegetation. In it the glides of the cradles, etc. are received
(To see in diagrams 4 and 5)
MACHINES AND TEAMS. -

1.- Scale.
2.- Discharge-silo chute. Inside this is installed a system of break of gathering bags and dispersion of the garbage to facilitate their selection.
3.- Elevation transporting band.
4.- Selection transporting band. Its location must allow discharge over the mill and foresee chutes connected to the silos with arrastre system por vacuum that provides a curtain of air of hygienic protection to the operatives.
5.- Mill. It consists on the adaptation of a mill of the type of hammers.
6.- Mixer proportioning of inoculate. It is the adaptation of an standard mixer.
7.- Chute-lung. To regulate the discontinuities in the feeding of the cradles.
8.- Dried area. E1 material can be dried in natural form.
9.- Soft mill and sift. It already crumbles the payment dry and it neither allows separation of piles that don't lose temper for the brevity of the bio-process, for their recycled and other small objects degraded.

10.- Vehicles and implements. For the transfer task and distribution of the material in the cradles to be carried out by small, farming tractors and mixers.
DESCRIPTION OF THE TECHNICAL PROCESS OF PRODUCTION.
STAGE I. - The entering of the urban solid waste into the Plant. It is weighed.
STAGE II. - Breakage and disjointed of the garbage in reception
STAGE III. - Tape elevadora, to selection room of inert.
STAGE IV. - Classification of inert in selection tape. A1 end of the tape overturns the organic matter.
STAGE V. - The separate organic matter is milled.
STAGE VI. - Mixing of the inoculo with the garbage and transport in the " mixer " to the gutters, with sequential distribution and identificatory signaling of truck trash so as to identify the area of origin of not allowed residuals, for alteration of the bioprocess.
STAGE VII. - Biotechnologic process, with controls of the parameters in permanent form until the end of the process.
STAGE INOCULOS. - Similar to the previous one but with laboratory preinoculo.
STAGE VIII. - Mill and sifted of the fertilizer. Packing and packed. Separation of batteries.
STAGE IX. - Recycling of water and lagoon muds.
ECOLOGICAL AND ENVIRONMENTAL ASPECTS. -
In this project whose main objective is eminently ecological, the environmental impact is completely positive and it even seeks, to collaborate with the Municipalities.

Key Dates

UTILIZATION - BIOTECHNOLOGY - ORGANICS - URBAN - RESIDUALS

References

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