Agrogeo Ltd.

Complex utilization of biowastes and bioenergy plant by-products in agricultural and environmental management

For Liveable and Sustainable Environment

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Introduction

Agrogeo Ltd. was founded by 9 members in 1988. The members are as follows: Hungarian State Geological Institute, Budapest; Viniculture Research Institute, Kecskemét; Bácsvíz Rt., Kecskemét; Directorate of the Kiskunság National Park, Kecskemét; Collage of Horticulture, Kecskemét.

Technological package of Agrogeo Ltd.

Since 2009 we have had a complex technological package consisting of the following patents in the field of agriculture and environmental protection

Procedures for the controlled treatment of municipal wastes:

Procedure for moderation of environmental pollution produced by

municipal solid waste landfills

Procedure for sewage sludge composting

Technologies for the effective utliization of food processing industrial and agricultural by-products:

Procedure for treatment of meat industrial waste

Procedure for complex utilisation

vegetable oil industry

Procedure for composting of solid phase animal manures

Controlled bioremediation of hydrocarbon contaminated soils

Remediation of hydrocarbon contaminated soils and organic waste

Aims

The main objective is the sustainable utilization of waste originated from agricultural and industrial, municipal activities as a soil fertility increaser product and as a useful and effective material for soil remediation processes.

Composting  Aerobic stabilization

About the controlled composting technologies

Combined use of conditioned mature compost end-product and (bio)energy plant wastes: FGD gypsum, hardened wood ash as a windrow cover or stabilizer additive:

- ✓ Significant reduction of total N loss and greenhouse gas emission,
- ✓ Tapping of malodorous gases,
- ✓ Lowering the total amount of compost heap leachate,
- ✓ Substitution of expensive natural minerals, peats, artificial impermeable or semipermeable polymers.

The new generation microbial inocula for intensification of controlled composting technologies

MICROCOMP-GEOCELL®

GMO free inocula

Marketed Product

Effective lignocellulose degradation

Lowering the total N loss

Decrease of total volume

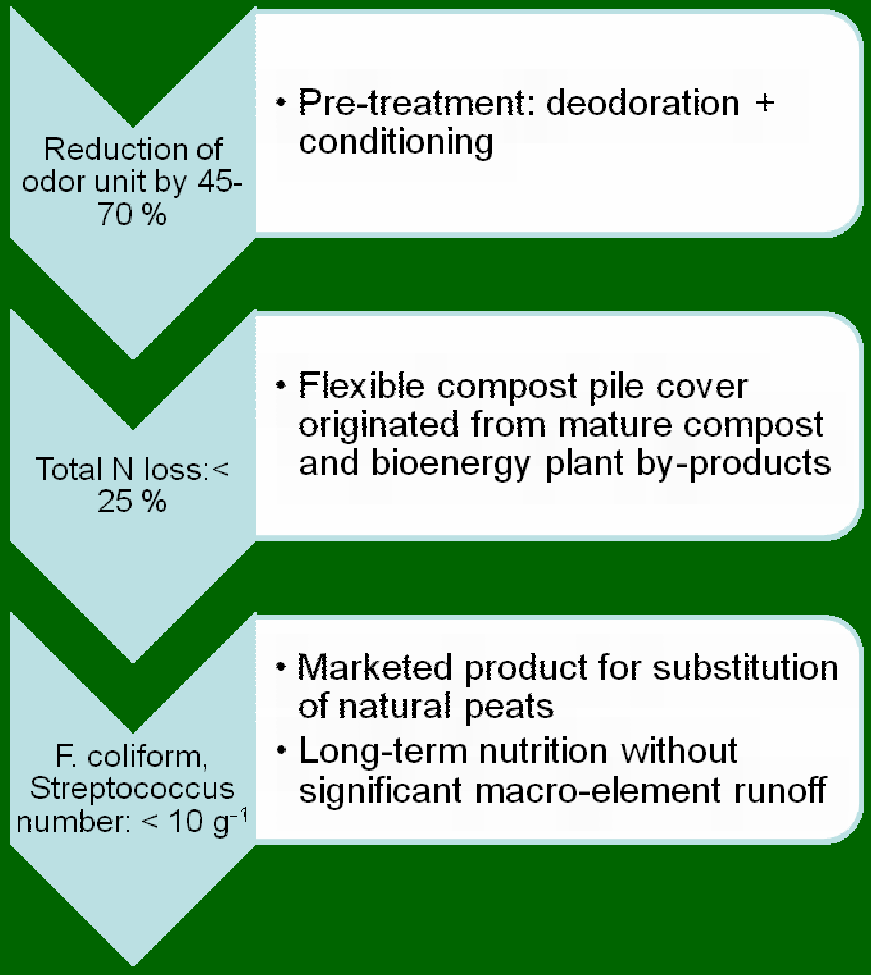
Stimulation of plant growth promoting rhizobacteria

Suppression of soil borne pathogens

Reduction of plant protection cost

Raw metarials for the controlled composting procedures

- ✓ Municipal solid waste,
- ✓ Municipal sewage sludge,
- ✓ Meat industrial wastes,
- ✓ Wine processing industrial by-products.



Bio-monitoring system for a Best Qualtiy Compost Product

Test of extinction of bioluminiscence of bacteria Vibrio fischeri + Growth *Inhibition Test* of terrestrial *plant root* Sinapis alba.

- During the intensive phase of composting and maturation

Static and Dynamic Respiration Index + Dewar self –heating test

- Monitoring for compost stability

Electronic nose + Dynamic olfactometry

- Odor control for organic wastes and exhaust air

Controlled composting technology with the bio-cover system

Decomposition material	**Triangular heap with bio-cover originated from stabilized biowastes**
Type of moistering	Not necessary
Aeration system	Pressure aeration
Turning machine	Not necessary
Times of turn	Not necessary
Time of the intesive phase	28 days
Water content of the fresh composting mixture	50-65 %
Water content of the end-product	> 30 %

Results of the full-scale composting of digested municipal sewage sludge: 20 m^3 sewage sludge + 40 m^3 chopped green waste

Parameters	Controlled composting technology : with microbiola additive + flexibile windrow cover originated from stabilized biowastes	Control :without microbial inocula in encapsulated impermeable windrow cover with on floor aeration
Total N loss %	22,4	31,6
F. Coliform number /g of compost product	9,2	$2,7 * 10^2$
F. Streptococcus number /g of compost product	6,4	3,6 * 10
Higienization period. > 55 ^oC heap temperature	2,3 weeks	1,7weeks
Dewar-self heating test for 105 day-aged compost	24,7	34,9
Aeration type	0,6 m^3 / m^3 mass/ hour	0,6 m^3 / m^3 mass/ hour

Average costs for the controlled composting technology

4 USD for 1 wet ton biowaste

- Pre-treatment and handling cost for biowastes before the composting process

5 USD for 1 ton bio-cover

- Production of bio-cover from composted biowastes and (bio)energy plant by-products which is suitable for covering of 12 m^2 of compost windrow

35 USD treatment cost for 1 wet ton

- Microbiological additive + on-floor aeration + classification, screening-crushing

Partners for effective R&D and Innovation:

- Törköly-Komposzt Ltd.
- **RESEARCH INSTITUTE FOR SOIL SCIENCE AND AGRICULTURAL CHEMISTRY OF THE HUNGARIAN ACADEMY OF SCIENCES**
- Geosan Ltd.
- Pilze-Nagy Ltd.
- Szent István University Gödöllő

Procedure for controlled composting of digested municipal sewage sludge

The full-scale trial was carried out in the RotoComp system in 2009.

Forced aeration + mature municipal sewage sludge compost + MICROCOMP-GEOCELL®

The controlled composting technology

Mixed municipal sewage sludge and chopped green waste

The controlled composting technology

+Microbial additives for the intensification+

The controlled composting technology

Pre-treatment of input materials

The controlled composting procedure

Homogenization of input by-products

The controlled composting technology

Good structure for the suitable air permeability

The controlled composting technology

GREEN-BAGGER loader

The controlled composting technology

GREEN-BAGGER

The controlled composting technology

Encapsulated tunnel system

The controlled composting technology

Aeration system

The controlled composting technology

The RotoComp system 1

The controlled composting technology

The RotoComp system 2

Basal and top-dressing of winter wheat (Triticum aestivum sp.) with D-compost **originated from digested municipal sewage sludge and green waste**

Basal and top-dressing with municipal sewage sludge and biogas effluent

Aims

Objective of the field-scale experiment was to develope a new soil-manuring system based on the use of digested municipal sewage sludge and biogas effluent originated from pig slurry and spent mushroom substrate

Material and method

- Combined basal dressing with MSS compost and biogas effluent in reduced tillage system.
- Top-dressing with conditioned MSS compost + N fertiliser using winter wheat test plant.

The field-scale top-dressing experiment was carried out in 2010.

Test plants

MSS compost product, 2010

Top-dressing with MSS compost

Top-dressing with MSS compost + ammonium nitrate fertilizer

The Micro-plot Experiment, 2010

Results

Test plant: winter wheat, 2010

Plant height

- 62,75 cm for control
- 81,52 cm for MSS compost + N fertiliser

Spike density

- 424 number/m^2 for control
- 491 number/m^2 for MSS compost + N fertiliser

N supply of winter wheat

- 1,7 % for control
- 2,3 % for the MSS compost treatment

Soil manuring with B-compost originated from digested manure, molasses based vinasse, wood ash

Test plant: sweet pepper (Capsicum annuum sp.)

2009

Aims

- The aim of the field trial was to investigate the effect of soil manuring with bioenergy by-product compost on the yield of green peppers in micro-plot system.
- Soil type: calcareous loamy sand
- **Four treatments: untreated control, compost 10 t/ha, compost 20 t/ha, complex fertili**ser

Four treatments in micro-plot system (in year 2009)

Compost treatment (10 t /ha)

Sweet pepper production of compost treatment (10 t/ha)

Results

Yield

- 33,5 ton/ha for the control treatment
- 44,3 ton/ha for the compost treatment (10 t/ha)

N supply

- 2,4 % for the control
- 3,2 % for the compost treatment (10 t/ha)

K supply

- 5,1 for the control
- 6,8 for the compost treatment (10 t/ha)

Controlled bioremediation of hydrocarbon contaminated soil

Combined use of municipal sewage sludge compost and mircobiogical additives

2010

Aims

The aim of the field trial was to develope a new technology for ex situ bioremediation of TPH and PAH contaminated soil using compost based inocula carrier.

Municipal sewage sludge compost

Microbial additive

To investigate the degradation level of hydrocarbon micro-pollutants in the „Roamng Cell" system

TPH (C5-C40)

Total PAH (19)

To investigate the effect of bioeremmediation technology on the microbiological properties during the full scale trial

Integrated ecotoxicological test

Specific enzyme activity

About the bioremediation technology

Hydrocarbon

- TPH (C5-C40): 1570 mg/kg
- PAH (19): 29,3 mg/kg

Biostimulation

- Municipal sewage sludge compost + Geopetrol-1 microbiological additive
- Dose: 5 w/w %

Remediation system

- Roaming-cell: it is a mobile closed system which is made of polystyrene
- On-floor forced aeration

Pre-treatment and homogenization of hydrocarbon contaminated soil

The „Roaming-Cell” System

The „Roaming-Cell” System

The „Roaming-Cell” System – Sample taking

Results
Full-scale trial in a closed system

TPH degradation level:

75 % for the new technology: MSS compost + microbial additive

51 % for the control treatment (only NPK complex fertiliser)

PAH (19) degradation level:

62 % for the new technology: MSS compost + microbial additive

37 % for the control treatment (only NPK complex fertiliser)

4-month period controlled bioremediation in closed „Roaming-Cell" system

Total number of hydrocarbon degrader microorganisms at the end of the bioremediation process:

6,4 *10^5 for the new technology: MSS compost + microbial additive

5,2 *10^2 for the control treatment (only NPK complex fertiliser)

Temperature of the contaminated soil at the end of the bioremediation process:

28,7 °C for the new technology: MSS compost + microbial additive

19,4 °C for the control treatment (only NPK complex fertiliser)

Average costs for the controlled bioremediation technology

5-10 USD for pre-treatment of 1 wet ton

- Homogenization and manipulation cost of the contaminated soil before the bioremediation process.

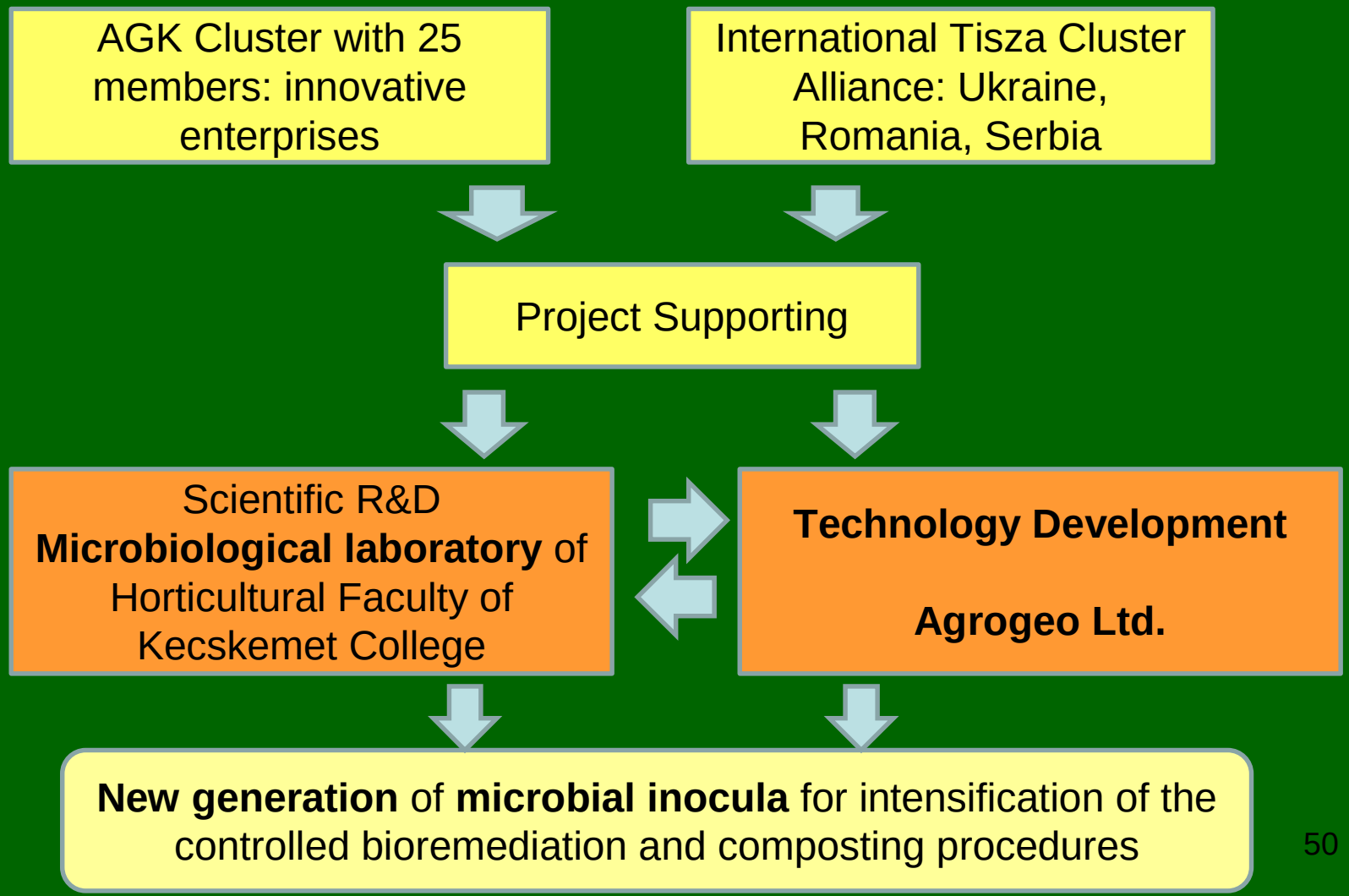
Aeration cost for 1 wet ton: 14-20 USD

- Aeration or turning of the soil-windrow system

Microbiological additive for 1 wet ton: 25-35 USD

- Intensification of the controlled bioremediation process

Network for the successful R&D and Innovation



Marketed products to preserve soil fertility:

- ✓ Bioalginit®
- ✓Szelarit®

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Marketed products

- **MICROCOMP-GEOCELL** microbial product for intensification of the composting process,
- **GEOPETROL, PETROHUM, SAFEREMED** microbiological additives for the controlled bioremediation of hydrocarbon contaminated soils.

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Thank you for your attention!