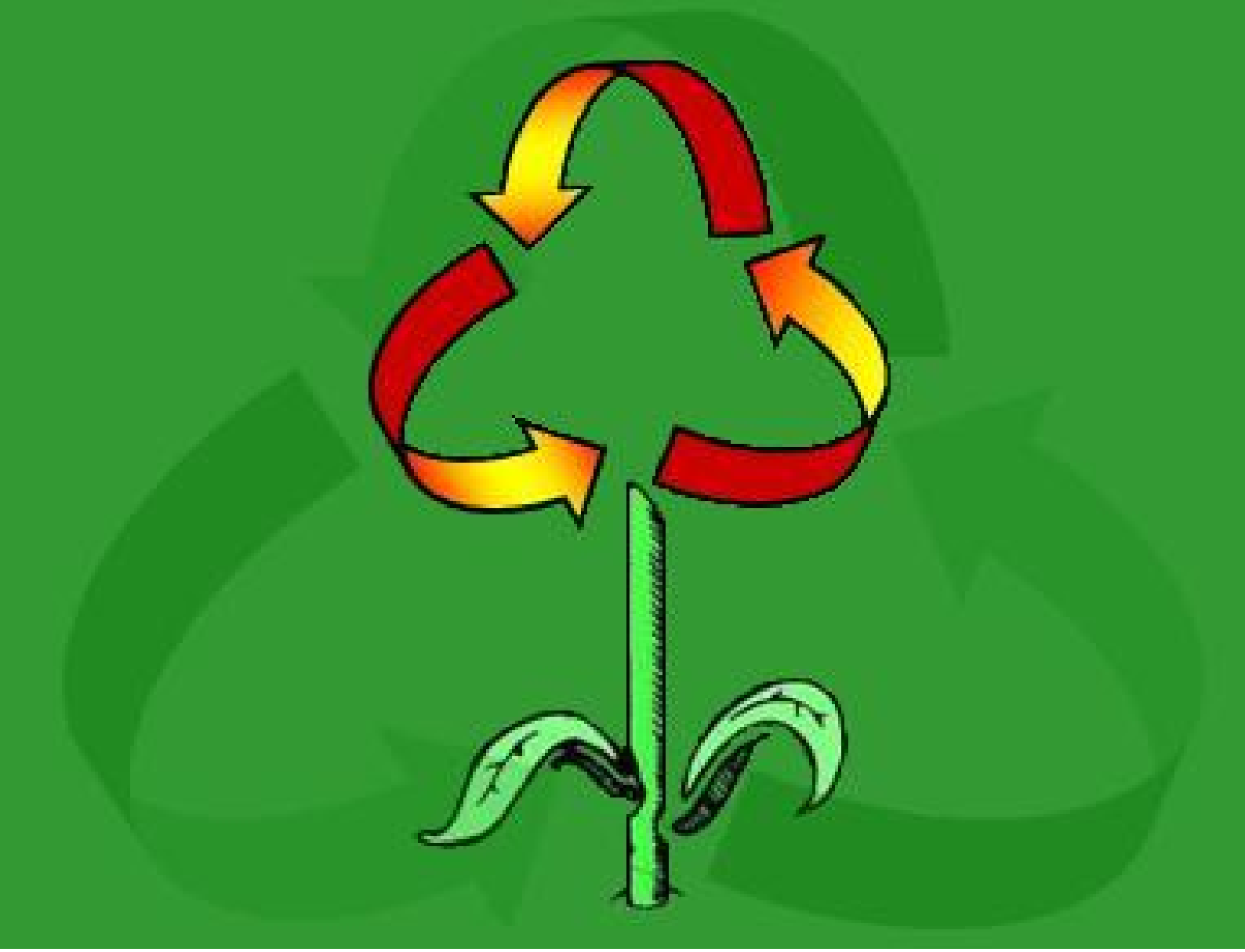

LAYMAN'S REPORT

LIFE05 TCY/MA/000141

Design and Application of an Innovative Composting Unit for the Effective Treatment of Sludge and other Biodegradable Organic Waste in Morocco

composting
MOROCOMP

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Introduction

MOROCOMP is a Life-Third Countries Project co-funded by the European Community with title "Design and Application of an Innovative Composting Unit for the Effective Treatment of Sludge and other Biodegradable Organic Waste in Morocco - LIFE05 TCY/MA/000141" and Morocco is the beneficiary country. The basic aim of this project is to develop and establish an innovative in-vessel composting system for the integrated treatment of sludge and other biodegradable organic waste (BOW) in Morocco in order to enable the operators and National Authorities to treat, control and reuse the sludge and other BOW effectively and in consistence with the European Environmental Policy. The project implementation will protect the water-bodies and soil from untreated and uncontrolled sludge disposal in order to promote the protection of public health and the environment. At the same time, the use of treated sludge and other BOW as soil improver will substitute or reduce the use of chemical fertilizers and subsequently protect arable land from degredation and the surface and ground water from contamination.

The beneficiary/coordinator of the project is the (UCD) while the National Technical University of Athens and the Regional Office of Agricultural Development (ORMVAD) are the two partners of the project.

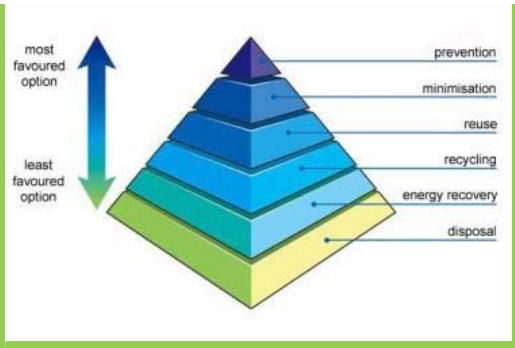
Stages for the implementation of the project

Assessment of the existing situation in Morocco and in the EU

A complete recording and analysis of sludge and other BOW generation, treatment, reuse and disposal in Morocco and in EU was carried out. In addition the related EU legislative framework on sludge and BOW management was assessed. Finally a thorough review on sludge and other BOW composting practices in the EU was also performed while related success stories on EU composting facilities which incorporate state of the art technologies for organic waste treatment was reviewed.

Design and construction of an innovative sludge composting system

The development and implementation of an effective and innovative in-vessel composting system, took into consideration factors such as local characteristics, proven technology, environmental impacts, minimal risk to public health, compliance with EU environmental legislation and policy, sustainable market for the end product, flexibility and use of materials of Mediterranean origin as additives. The composting system was designed in such a way as to ensure the minimization of odours and process time by controlling operational parameters such as airflow rate, temperature and agitation and to produce high quality compost.
Utilization of this system is an attractive option to produce a useful material from sludge and other BOW in an environmentally friendly manner.
The composting system is installed in the premises of the ORMVAD at Zemamra (Morocco) located approximately 70 km from the town of El Jadida.



EU hierarchy on waste management

Front view of the composting facility

In vessel composting bioreactor

Agitation system

Compost collection portals

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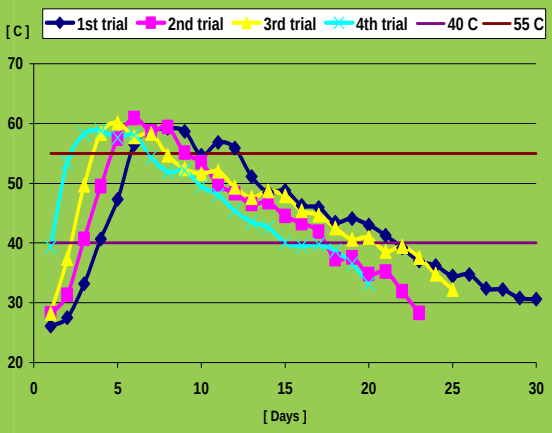
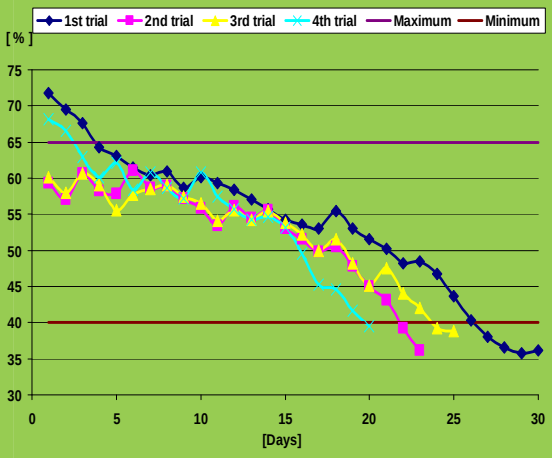
Development of sludge aerobic composting processes – Optimisation of the operation of the pilot composting systems

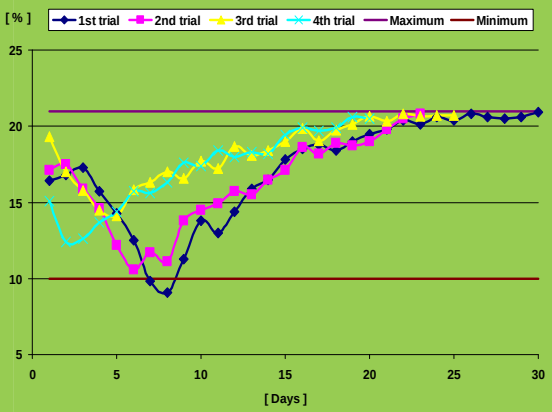
The characteristics of the raw material that is used for composting are fundamental to the biological conditions involved in composting since they determine a priori the physicochemical conditions of the process. For this reason extended analyses were performed for the characterisation of the raw materials that had been used for composting. These materials included primary sewage sludge from the city of El Jadida, secondary sludge from food industry, sugar beet leaves, straw residues, sheep and cow manures in various ratios whereas additives of Mediterranean origin such as zeolite and perlite were also used.
To determine the optimal course of composting different composting trials have been performed using the aforementioned waste and additives in various ratios and under different operational conditions (air supply, agitation and hydration level). These experimental trials were focused on the compost quality characterisation and on the effects of the operational conditions on the efficiency of the process, as well as on the end product quality. The selection of the experimental set-up was determined according to the feedstock material and its characteristics while at the end of each trial valuable feedback was obtained for the optimisation of the next composting trials. The temperature, moisture and oxygen content of the substrate was closely monitored on a daily bases during composting while for the evaluation of the processes complete physicochemical analyses have been performed (i) to the substrate throughout the duration of the composting processes (ii) to the derived product resulting from each composting trial and (iii) to the leachates produced from each composting trial. Furthermore biological and micro-biological analyses have been performed prior and after the composting processes to estimate the density reduction of pathogenic microorganisms since sludges contain great amounts of pathogens which constitute a health hazard for plant and human contamination. Finally heavy metal speciation has been performed to the produced compost in order to evaluate the potential accumulation level of heavy metals by plants when compost is applied.
On this stage the operation of the in-vessel composting unit was optimised based on the selected raw material while the analyses have shown that the produced composts is of high quality.



Temperature (°C)



Moisture (% H_2O)



Oxygen (% O2)

Evaluation of compost products as soil improvers

Composts that use raw material which originates from sludges can be potentially harmful to human health as well as to the environment when applied on land. To evaluate the suitability for agricultural application of the compost products resulting from the in-vessel composting system, series of laboratory phytotoxicity tests have been performed to examine the effects of composts on seed germination and plant growth. Moreover open field experiments were implemented to examine the effects of compost application to the quantity and quality of the yield of specific cultivations in real environmental conditions and the effects of compost to the physicochemical characteristics of the soil where compost was applied.
The phytotoxicity tests have shown that the produced composts are phytothreptic which is evident of the absence of potential phytotoxic compounds that can inhibit seed germination or damage plant growth. In addition the field experiments have shown that the produced composts have stimulating effects on plants growth (+ rest of experimental data)

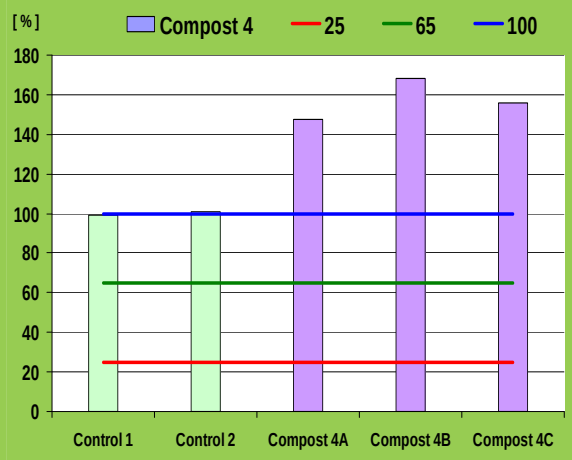
Alternative uses of compost – Market opportunities in Morocco

The potential of compost marketing in Morocco was identified and assessed based on the quality of the soil, the need of compost in agriculture and in other land applications. The assessment took into account the current and future availability of the composted raw materials (sludge and other BOW) and the quality of the produced compost and its compliance with the Moroccan and EU legislation.

Development of guidelines and specifications covering the sludge composting process - Characterization and use of compost as soil improver

Assessments have also been performed and resulted (i) in the development of specification on the optimum operation of the in-vessel composting unit (ii) providing guidance to competent authorities in Morocco in the development of a set of robust and commercially beneficial compost standards and end use specifications in Morocco based on the existing worldwide experience as well as (iii) test methods for the evaluation of the produced compost.

Field experiments



Phytotoxicity tests

Results of the project for potential target groups

The outcome of the project has a great impact to all the actors involved in the field of the generation and management of sewage sludge and other BOW. In particular:

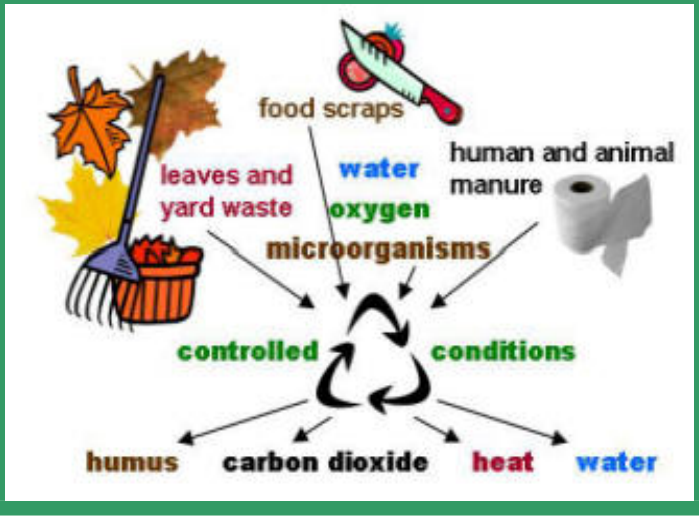
Farmers: Farmers in Morocco can be provided with a rich in nutrient and chemical elements fertiliser that will enrich soil properties/characteristics and enhance crop yield without the addition of chemical fertilisers which can be expensive and hazardous to the public health and to the environment.

General public: General public can benefit from the use of compost by its application in private gardening, growing media etc.

Local authorities: Local authorities are provided with a system for the effective treatment of sludge and other BOW and the production of compost that can be used. This, results in the reduction of the amount of biodegradable organic waste to be treated or sent to landfills. A product is obtained with added value that can contribute in creating job opportunities and earn money by marketing it.

Private companies: Private companies can benefit from the production of high quality compost that can be marketed and thus expanding industrial activity with a positive impact on the economy.

Decision and policy makers: The application of the system in large scale, will contribute in diverting BOW from landfills and in the uncontrolled disposal of sewage sludge in an integrated and sustainable way.



Environmental benefits

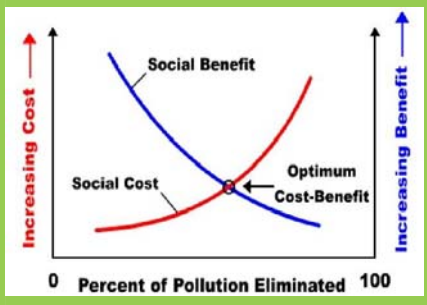
The outcome of the project results in significant environmental benefits such as:

- Reduction of the amount of untreated sludge that is disposed
- Diversion of BOW from landfills, contributing to the reduction of green house gases and extension of current landfill longevity
- Raising environmental public awareness
- Reuse and conservation of valuable biosolids-borne constituents through land application of compost
- Production of a material with added value that could be used on land as soil fertilizer, soil improvement and soil conditioner
- Replacement or reduction of the use of synthetic fertilizers for agricultural purposes and thus reduction of nitrate contamination
- The proposed composting technology has the potential to treat a range of waste streams reducing the environmental impacts from their disposal.

Cost benefits

The application of the technology could result in cost savings in the sector of the waste management since:

- The composting system that has been designed and manufacture is a low cost system that can be used to treat waste
- The system provides a controlled and fast composting method with better quality and higher quantity end product in comparison to other composting systems (e.g. windrow composting, aerated static pile composting) thus making it more profitable
- A product with high added value is produced, by transforming a waste into a useful high quality end-product good enough to be marketed.
- The potential substitution of the synthetic fertilizers used for agricultural purposes by compost leads to saving of cost for raw materials and energy.
- Small or medium size isolated areas can use the decentralized system for the treatment of the organic fraction of municipal waste and other BOW and sludge in a much more cost-effective manner than transporting waste to long distance centralized facilities
- Individuals that produce BOW can use the system developed to produce a high quality product with economic interest– added value.
- Farmers in the long term and especially those that employ organic farming can benefit financially from the use of compost that originates from BOW.

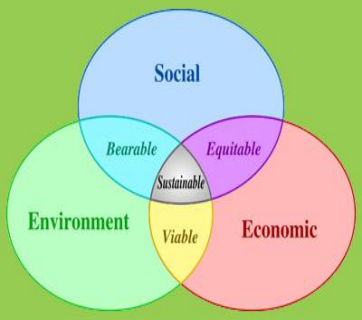


Replicability and transferability

The project is characterized by a high level of transferability and potential for commercialisation, due to the following:

- The use of such a system in large scale applications presents a high level of viability:
  - Low investment and operation and maintenance costs
  - The system is based on a well-documented and reliable technology
  - Significant and tactile

- The technology that was developed focuses on the effective treatment of sewage sludge and other BOW in an easy and simple way. In addition the capacity of the composting system can be adjusted according to the quantity of sludge and BOW to be treated in a region and thus ensuring its possible application in large scale.

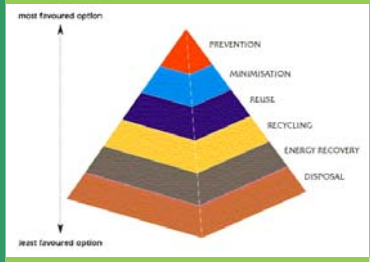


- The end-product is characterized by a high quality level allowing its possible trading utilization through the development of the relative market.

- The application of the systems is based on the principles and the priorities of the European and national environmental legislation and policy, fact that facilitates its easier incorporation in the existing waste management schemes.

- Sludge and other BOW management is a widespread environmental problem, common in all the countries, fact which indicates that the prototype system could be used extensively in European and other countries.

- Throughout the implementation of the project scientific and technical knowledge was acquired which can be disseminated to parties that are interested in:
  - the integrated and sustainable management of biodegradable solid waste
  - the application of environmental friendly products such as compost for the improvement of soil fertility



- The composting system has the ability to operate at similar conditions at local level using different feedstock material. Even in many EU countries the treatment of this feedstock material constitutes a threat to the environment and they are seeking for sustainable solutions.

- The system can be applied in other regions in Morocco or even in other developing countries for the effective treatment and management of biodegradable waste.

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Beneficiary UCD **Partner NTUA** **Partner ORMVAD**