Themis LAB

THEMIS R&D PROJECTS

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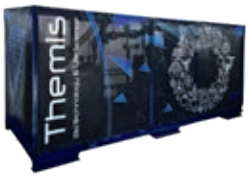


The Research & Development activity carried out within our laboratory is what makes THEMIS unique and at the forefront in the sector of innovative technologies for the Circular Economy.

THEMIS WRT is an innovative technology for the enhancement and/or drastic reduction of various waste capable of guaranteeing exceptional performance with minimum operating costs.

Thanks to the pilot plant available at our headquarters in Legnano, preliminary test sessions are performed for the industrialization phase which, in addition to validating the results envisaged by the initial project, allow us to carry out an intense Research & Development activity in collaboration with University and Research Centers.

TARGETS

Production of a product equivalent to a mixed composted soil conditioner.

Transformation of the wet fraction in a short time (8-10 h), without the production of unpleasant odours, absence of gaseous emissions and production of complex water/leachate.

Concentration of the original volume between 65-80 %.

Reduction of the costs of bio transformation.

Large-Scale Retail Distribution

OFMSW (Organic Fraction Municipal Solid Waste)

PROCESS

The molecular disintegration process was carried out with heat treatment of the matrix at low temperature with the aim of transforming it from a dense mass of organic into a mixed composted soil conditioner.

The treatment carried out allows for the transformation of the treated organic into a finished product in a few hours compared to the several weeks used with traditional methods, in the complete absence of odour, leachate, fermentation vapours, fire hazards and bacteriological contamination.

GOALS

Dried product with characteristics certified by specialized laboratories with the identical characteristics of the soil improvers used in agriculture.

Distilled product with certified characteristics for reuse or for discharge into the sewer according to the parameters provided for by current legislation.

Reduction of environmental pollution, reduction of residual mass, lack of production/emission of gas (closed circuit) and foul-smelling fumes, ease of management of the product stored in output.

TARGETS

Separation by fractionation of the solvent content in the matrix to be treated.

Dehydration of the sludge and granulation of the dried product.

Elimination of bad smells deriving from the treatment of sludge with chemical products.

Reduction of the volume of disposal.

PHARMACEUTICAL INDUSTRY

Pharmaceutical sludge, waste water

PROCESS

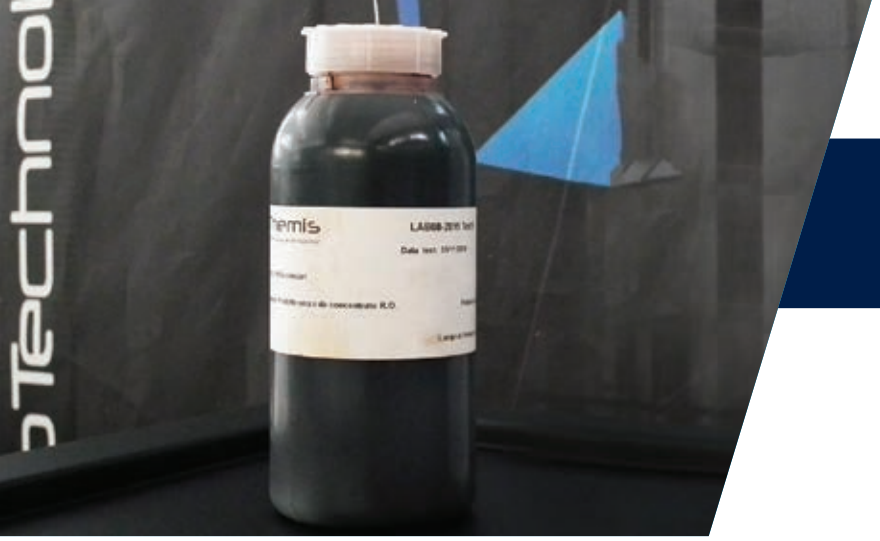
The treatment of mother waters with Themis WRT plant was carried out by fractional distillation with the aim of separating the components of the matrix having boiling temperatures that are not very different.
The sampling of the distillate products was instantaneous (every 5 minutes) from the predetermined sampling point of the distillate tank.
The sludge test campaign was conducted with an evaporation temperature between 50 ° C and 55 ° C with a constant vacuum pressure to favour the molecular fragmentation of the initial matrix, characterized by metering treatments with hydrated lime.

GOALS

Dried product of granular sludge leaving the WRT plant in the complete absence of odours and with a final dry substance equal to 90% and a volume/ weight reduction of 70%.

Distilled product from the treatment of mother liquors with characteristics suitable for discharge into the purifier.

Concentrated product from the treatment of mother waters sent back to the head of the WRT treatment plant.



TARGET

Reuse of the permeate for the leather tanning process.

Dehydration and granulation of the concentrated product and sludge.

Zero-Waste (on solid and liquid matrices).

TANNERY INDUSTRY

Tannery sludge and wastewater from tannery production

PROCESS

The test campaign carried out on the wastewater deriving from exhausted leather tanning baths lasted 6 months. The treatment process allowed the removal and concentration of all pollutants in a significantly reduced volume compared to the wastewater as it is without any use of chemicals.

It has been certified by the customer's internal laboratories that purified water can be reused for the leather tanning process regardless of the processing period or seasonality.
The concentrated product and sludge will be destined for vermicomposting which involves the biotransformation of a by-product through the use of some species of earthworm (Eisenia).

The scenario of reuse of the tanning sludge was identified by Themis in collaboration with the University of Genoa (MICAMO, spin-off biomolecular department).

GOALS

Permeate with certified characteristics for reuse for the leather tanning process.

Scientific study with the University of Genoa for the reuse of the dried product through the vermicomposting process, which involves the biotransformation of a by-product through the use of some species of earthworm (Eisenia).

TARGET

Maximum level of dehydration and granulation of the dried final product.

No generation of unpleasant odours.

PURIFICATION - EXCEEDING SLUDGE

Bio-carbonate

PROCESS

Bio-carbonate is a product that normally derives from wastewater treatments with hydrated lime and in this specific case derives from chemically treated and centrifuged excess sludge.

The initial substrate was very compact and difficult to separate as it was characterized by a strong molecular bond.
During the tests, the changes in the state of the matrix were analyzed in detail in relation to the various process parameters set on the WRT system software and the best operating process conditions were defined to favour the breakdown of molecular bonds and cell walls.

At the end of the treatment processes, we obtained a product with a high degree of drying and fine grain size (0.5 mm) for the use of the by-product as a filler for sewer pipes.

GOALS

Reuse of the dried product as a filler for sewer pipes.

Product dried at 92% TSS.

No generation of unpleasant or noxious odours in the process.

TARGET

Maximum level of dehydration and granulation of the dried final product.

Recovery of distilled water in the factory or transfer of the recovered water to the company purifier.

Extraction of molecules from final dried product.

FOOD

Scraps of vegetables, scraps of tuna fish, purification sludge, purification fats.

PROCESS

The test was carried out on every single matrix and on a mixture of matrices composed in a manner proportional to the production volume of every single matrix.

The initial tests were conducted with the aim of recovering distilled water and using the final dried product for the extraction of molecules with application potential for different sectors.

The project proposal, developed in collaboration with a leading Italian research institute, provides for the processing of waste resulting from production activities to extract elements of "bioactive compounds", composed of high application value in various industrial sectors such as:

- "Antioxidant / Anti-age" for the cosmetic sector;
- "Scrub" for household hygiene products;
- "Soap" for the cosmetic sector;
- "Anticancer-Antibiotic" for the pharmaceutical sector.

GOALS

Reuse of the dried product through the extraction process of bioactive molecules.

Total reduction of the disposal volume.

TARGET

Dehydration and granulation of the solid digestate.

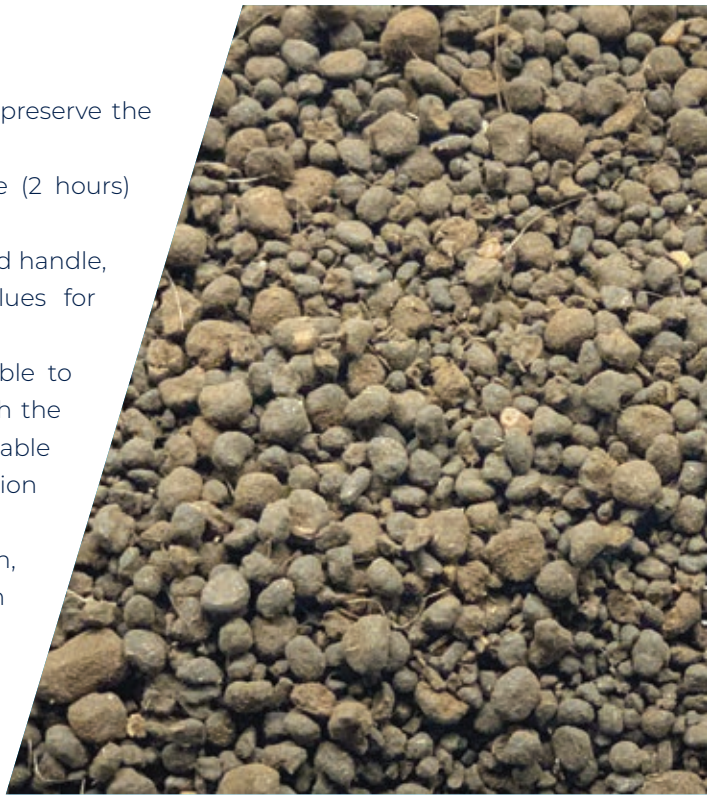
Dried product used for specific actions on plants and soil as biostimulants or high added value fertilizers.

ZOOTECHNICAL

Solid digestate from livestock waste matrices

PROCESS

The drying was carried out at a temperature of 45 ° C to preserve the quality characteristics of the final dried product.
The first test phase showed a very short treatment time (2 hours) compared to the normal composting processes in use.
The final dried product was found to be easy to manage and handle, while the distilled water obtained showed optimal values for discharge into surface water bodies.
During the evaporation and drying process, it was possible to inoculate, in a simple way, some specific elements through the WRT system, such as to enrich the product and make it suitable and ready for the soil for which it is to be used (precision agriculture).
The first subsequent tests, conducted in a phytotron, capable of studying the reaction of the product obtained in different climatic conditions and environmental conditions, demonstrate the value of the product obtained.
The primary objective is the innovation of the agricultural model through the use of by-products to optimize the production efficiency, product quality and profitability.

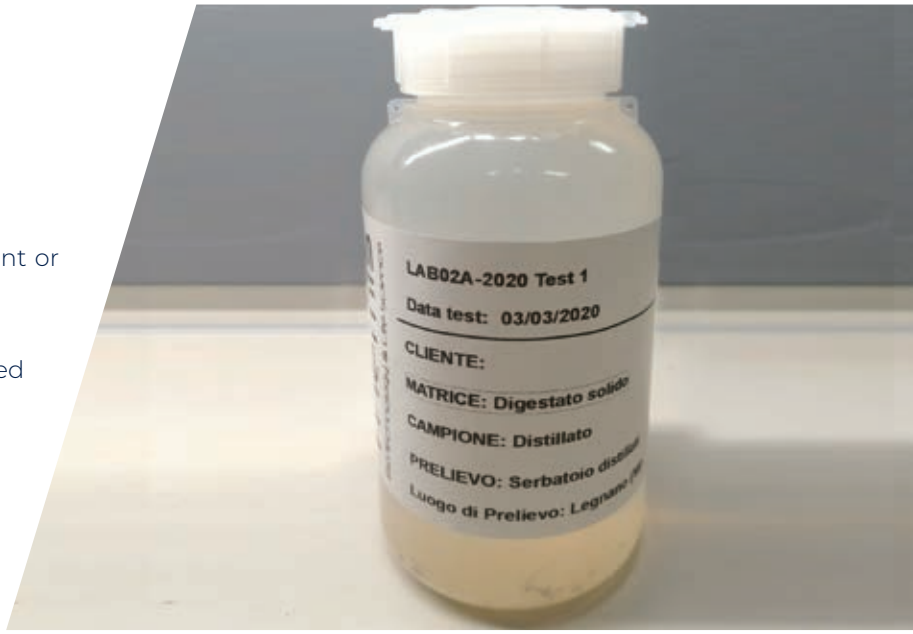


GOALS

Reuse of the final product as a biostimulant or fertilizer.

Innovation and development of the obtained by-product (Precision Agriculture).

Reuse of distilled water for fertigation.



TARGET

THC content reduction.

THERAPEUTIC HEMP

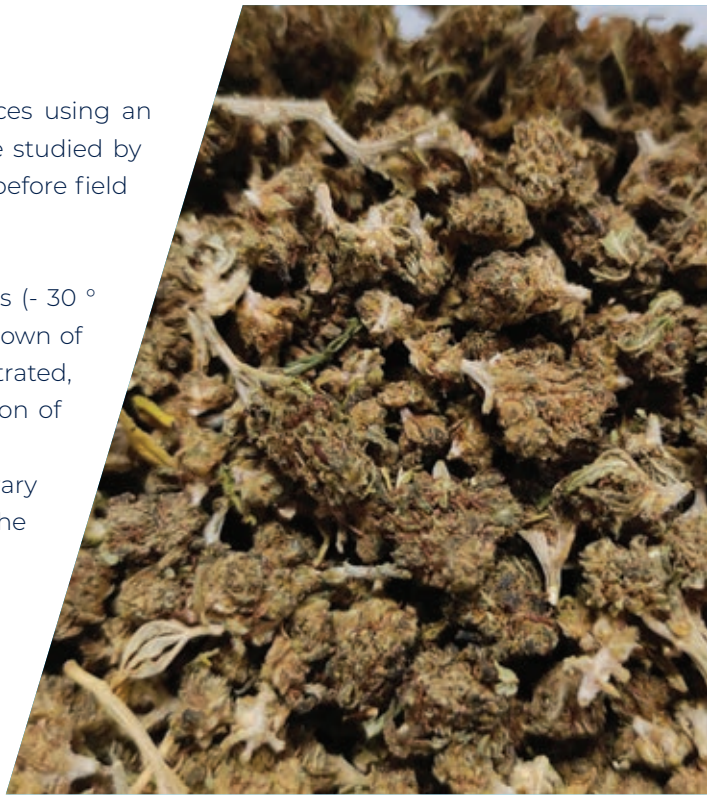
Hemp inflorescences

PROCESS

The test campaign was carried out on hemp inflorescences using an innovative process for which the exercise parameters were studied by Themis Lab researchers for several months of preparation before field tests.

The final process was carried out at negative temperatures (- 30 ° C) inside the mixing chamber in order to cause the breakdown of the trichomes, inside which the THC substance is concentrated, stimulating their separation through the effect of the action of the vacuum.
No solvents of any kind were used during the process, contrary to the normal distillation processes that use butane for the extraction of key components of plant materials.

Laboratory analyzes were carried out on the final product obtained which certify the reduction of 60% of THC compared to the initial value of hemp as it is.

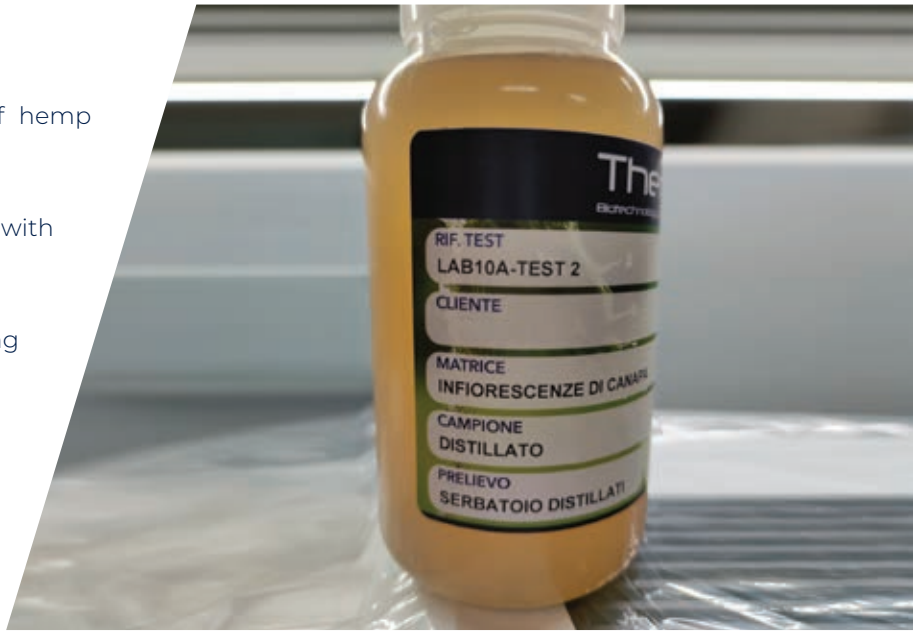


GOALS

Unique application for the treatment of hemp flowers.

Certified THC reduction in compliance with legal values.

No risk of damage to the product during treatment.



TARGET

Reduction of the waste volume to be treated.

Maximum dehydration and granulation of the dried final product.

Elimination of bad smells deriving from the treatment of sludge with chemical products.

Chemical reduction for sludge treatment.

Energy impact reduction for sludge treatment.

Treatment without operator intervention for WRT management.

Purification of industrial food water and complex matrices from the treatment of hazardous and non-hazardous waste (for third parties)

Excess sludge from purification activities in the industrial sector and purification of complex liquids

PROCESS

The input sludge had a very high dryness value (40% TSS) with a considerable quantity of inorganic material coming from the mixing with lime and chemical products used to inert and compact it.
The drying and evaporation of all the aqueous fraction took place in automatic mode and with surprising results for such a complex input matrix.
Carrying out of an endurance test campaign aimed at the volumetric reduction and granulation of the product. The product is not dusty, making it easier to manage the final storage.
No unpleasant odours were found in the final product and in the treatment of the initial product which had a high degree of odour aggressiveness.
In the study the determination of "standard formulation" for the realization of a different final product in order to qualify as a by-product.
The treatment phase was made automatic and "simple" thanks to the software that uses the principles of artificial intelligence and makes adjustments autonomously by managing all stages of the process in a stand-alone manner.

GOALS

Unique application for the treatment of complex matrices.
Significant reduction of the IRDP index.
50% reduction in weight/volume.
Perfect granulation of the non-dusty product.
No particular smell in the final product.
Minimum operator interventions only in the product loading and unloading phase (also automatable).

TARGET

Volumetric reduction of the matrix “as it is”.

Reuse of the dried product as green compost.

Reuse of distilled water for irrigation and/or secondary uses.

GREEN FRACTION

Foliage, twigs and leaves, cuttings

PROCESS

The treatment was carried out with the aim of transforming organic waste into vegetable compost.

The transformation of the treated organic material took place through a controlled process in a few hours compared to the several weeks used with traditional methods, in the complete absence of odour, leachate, fermentation vapours, fire hazards and bacteriological contamination.

The treatment of different shapes and materials did not involve additional work needs or particular stress on the machinery which, thanks to the sophisticated software, was able to adapt the different treatments to obtain a homogeneous and qualitatively appreciable result.

GOALS

Reuse of the dried product as green compost (appreciated and required in organic farming).

Reuse of the distilled product for fertigation and/or secondary uses.

Reduction of processing times.

TARGET

Reuse of treated water for the production of sanitary vessels.

Recovery of the raw material present in the liquid waste (slip) for the production of sanitary vessels.

CERAMIC SANITARY PRODUCTION

Liquid matrix coming from the sanitary washing and forming process

PROCESS

The product to be treated had very high generic complexities deriving from a mixture of liquid and solid abrasive and with a high sedimentation index.

It was, therefore, necessary to pre-concentrate the aqueous parts through optional units to the WRT system which allowed to carry out the filtration, ultrafiltration and nanofiltration processes.

Subsequently, the evaporation of the waste was obtained and a resulting dry product that could be reused as secondary raw material.

GOALS

Perfect recovery of all available water and subsequent reuse of the same.

Perfect recovery of the raw material.

Excellent treatment energy profile.

90% reduction of solid waste and recovery of the same.

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