

RE-CORD

Renewable Energy COnsortium for Research & Demonstration



Company presentation



BIOEXPO Nantes 8-9 February 2023

WHO WE ARE



RE-CORD is a private, not for profit, research centre, whose members are:



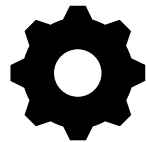
We are a multi-disciplinary team, made of 23+ researchers, covering the disciplines of:



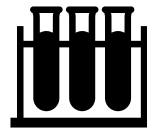
Energy engineering



Chemical Engineering



Mechanical Engineering



Chemistry



Economy



Biotechnology

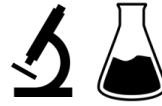
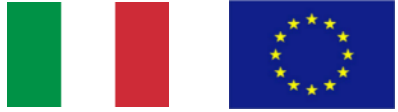


Agriculture

....Together

we perform independent research activities to support Innovative Industries in the development of new sustainable processes for renewable energy and valuable materials recovery

WHERE WE ARE



Headquarter
Laboratory & offices



REC PARK
Experimental Area
(450+450 m²)



Office space @UNIFI
Department of Industrial Engineering



Experimental area «Montepaldi»
Agricultural field trials

MAIN ACTIVITIES



Bioenergy and biofuels

Converting residual organic matter in advanced liquid and solid biofuels

We perform research and experimental campaigns in our pilot units

Materials tested:

Sludge, agro-residues, urban biowaste, bioplastics, industrial co-products



Waste valorisation and materials recovery

Thermochemical treatment combined with chemical extraction of high value materials from waste streams

We develop and tests extraction systems for industries

Materials tested:

Leather, pharmaceuticals, batteries, paper mill, polymers



Decarbonization of industrial sector

Renewable fuels use and waste energy recovery in large scale industrial complexes

We develop assessment, studies and projects for industrial actors

Industry sectors approached:

Steel sector
Power sector
Oil & Gas

MAIN ACTIVITIES



Academic research

Investigating and testing new emerging process routes

We cooperate and work with universities promoting research pathways and campaigns

Cooperation with research centres and universities in more than 30 countries



Biofertilisers production & testing

Characterization and trials on innovative organic and inorganic fertilisers

Production tests for extraction and use of advanced fertilisers and fertilising elements from biological materials

Fertilisers produced: biochar, compost, com-bi, phosphates, liquid NPK



EU Policy consultancy

Supporting EU institutions in the development of new directives and regulations

We are actively involved in the development of EU directive on renewable energy and fuels, and on EU fertilisers regulation

EU institutions:
DG RTD, DG GROWTH, DG ENERGY, JRC



ASSETS & FACILITIES

RE-CORD LABORATORY



- ❖ Gas chromatographs (GC-MS and GC-FID)
- ❖ High pressure liquid chromatograph (HPLC)
- ❖ Ion chromatograph (IC)
- ❖ Spectrophotometer
- ❖ ATR FTIR spectrometer
- ❖ ICP-OES
- ❖ Calorimeter
- ❖ Elemental analyzer (CHN-S)
- ❖ Thermogravimetric analyzer (TGA)
- ❖ Ash fusibility analyzer
- ❖ Specific surface area analyzer (BET)
- ❖ Oxidation stability analyzer (Petroxy)
- ❖ Calcimeter
- ❖ Karl Fisher titrator
- ❖ Rotavapor
- ❖ Syngas Analyzer/mGC/combustion gas analyzer
- ❖ Reactor for anaerobic digestion (biogas)
- ❖ Richards plates





THERMAL PROCESSES

BUSINESS UNIT

THERMAL PROCESSES



Most recent lines of research:

- Slow and intermediate pyrolysis
- Hydrothermal liquefaction (HTL)

Facilities:

- Milling, sieving, pelletizing, briquetting units (50-100 kg/h)
- cHTL - Continuous hydrothermal liquefaction unit (1.5 l/h)
- CarbON - Fixed bed oxidative slow pyrolysis unit (50 kg/h)
- PYROK - Rotary kiln slow pyrolysis unit (100 kg/h)
- SPYRO - Slow/intermediate screw pyrolysis unit (1 - 5 kg/h)
- Garrett microturbine converted to biofuels (20 kWe)
- G.E.K. - Downdraft gasifier (10 kWe)
- Tar sampling unit
- Lab-scale furnace for char activation
- MRTB - test bench for high P/high T batch tests
- Lab-scale press for oil extraction from oleaginous biomass
- Continuous chemical leaching unit



Design, build and operate our own pilot units

Head:

Dr. Edoardo Miliotti (energy engineer)
edoardo.miliotti@re-cord.org

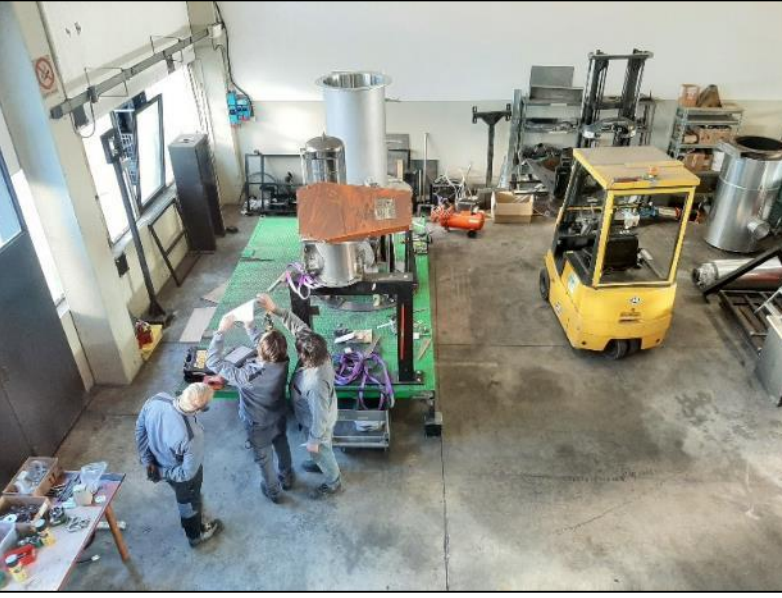
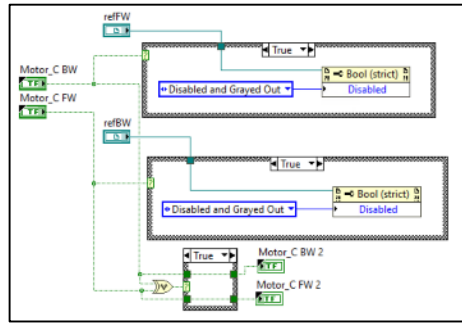
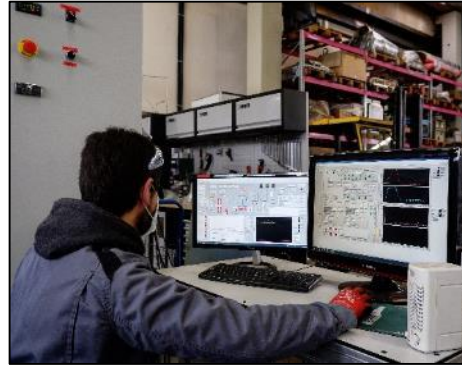
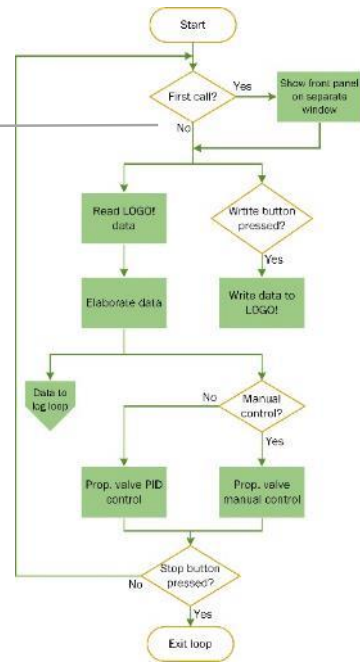
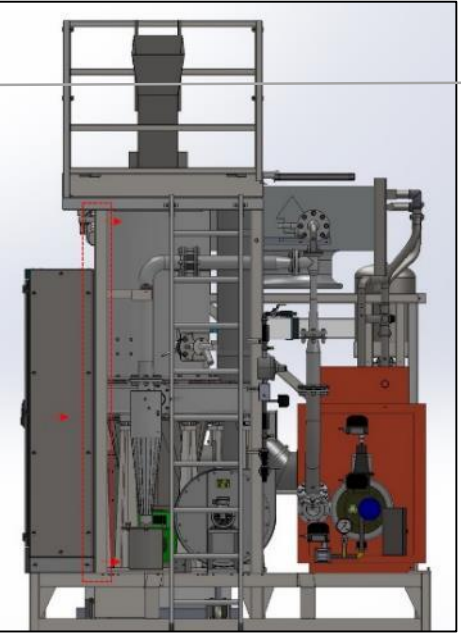
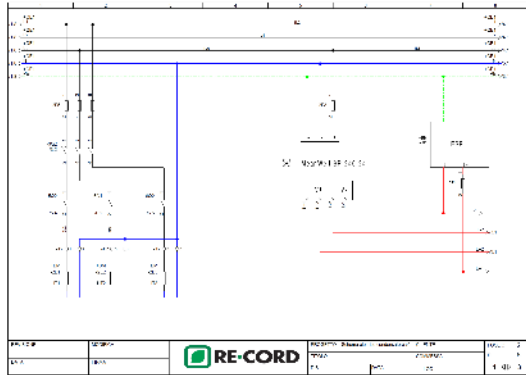
Core team:

Giacomo Lombardi (R&D Engineer)
Arturo Di Fraia (R&D Engineer)
Alessio Miniati (R&D Engineer)
Simone Piazzini (Technician)

THERMAL PROCESSES

360° approach to our prototypes

- Mechanical and electric design
- 3D modeling (SolidWorks)
- Programming (LabView)
- Assembly
- Operation
- Maintenance





AGRO-BIO-CLIMA

BUSINESS UNIT



Lines of research:

- Agronomic trials (on field and climatic chambers with lysimeters)
- Tailored biochar production for specific applications (e.g., drug delivery, additive for microbiological processes, sorption material, nutrient retention, etc.)
- Anaerobic digestion process at lab and pilot scales
- Microalgae production plants, ponds and reactors design

Facilities:

- Experimental area for agronomic tests
- Climatic chamber for indoor trials
- Composting production prototypes
- Anaerobic digesters (lab and pilot scale)
- Microalgae lab photobioreactor – solar simulation for algae



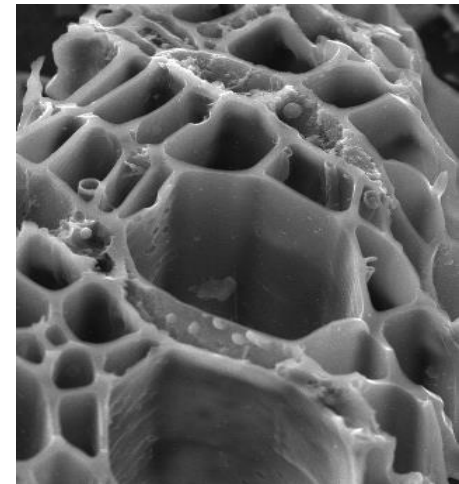
Exploring circular and sustainable bio-based solutions

Head:

David Casini (environmental engineer)
david.casini@re-cord.org

Core team:

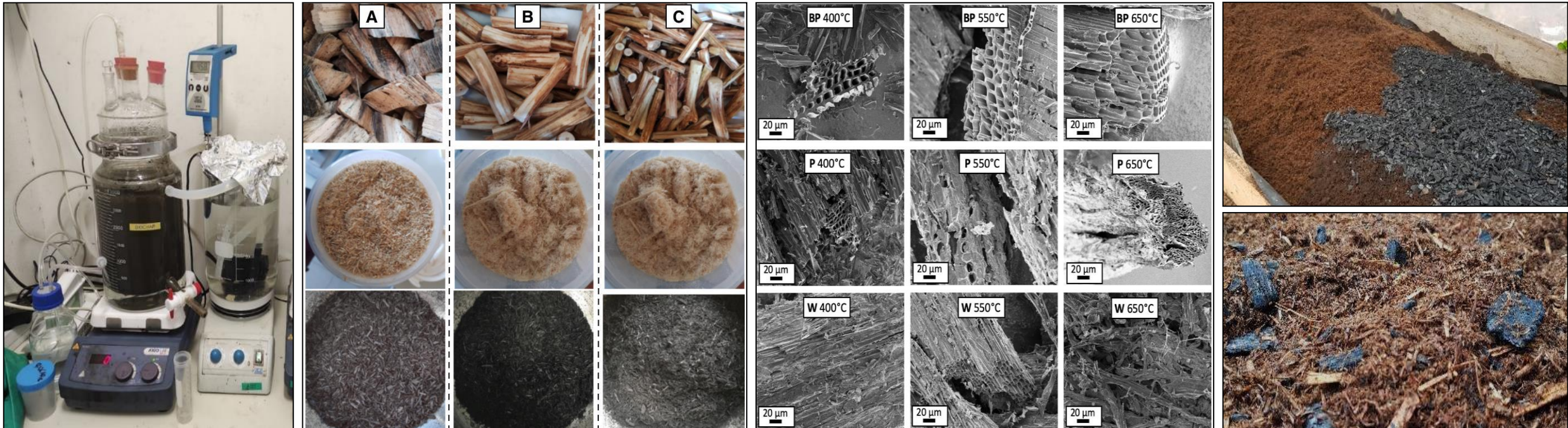
Tommaso Barsali (senior R&D agronomist)
Dr. Francesca Tozzi (R&D agronomist)
Damiano Stefanucci (R&D biotechnologist)



TAILORED BIOCHAR



- Tailored biochar production for specific applications through **feedstock and process parameters selection**
- **Development of custom-made products:** drug delivery vector, additive for microbiological processes, sorption material, nutrient retention, etc.
- **Postproduction treatments** to comply specific quality standards (e.g., soil improver, nutraceutical and pharmaceutical grade, etc.).
- **Product performance evaluation and comparison**

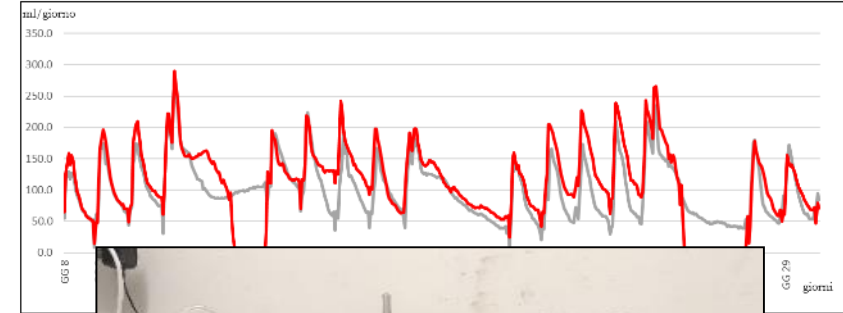
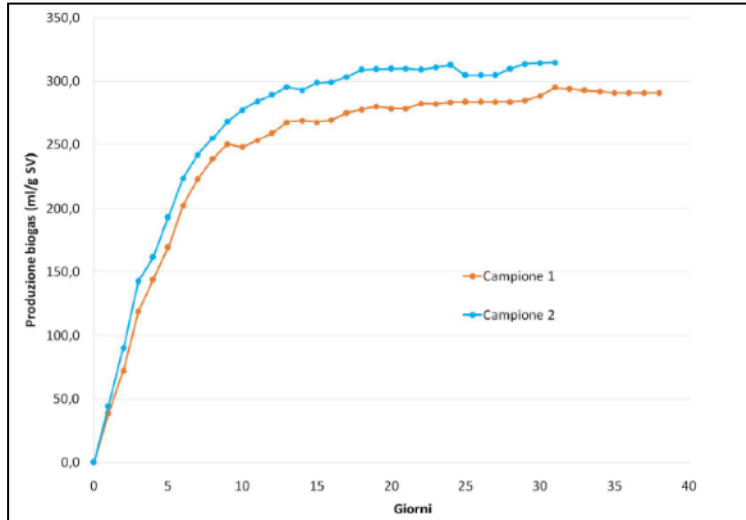
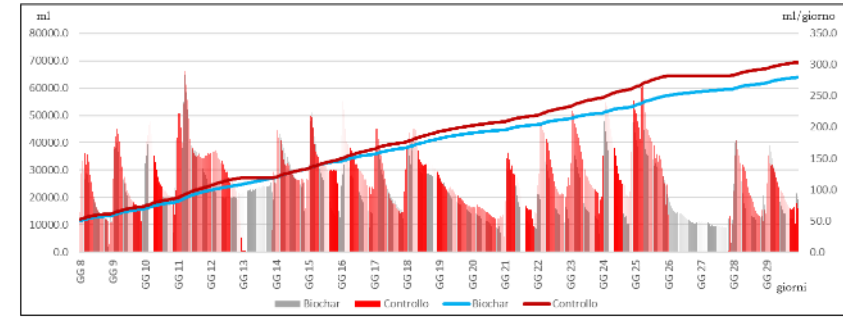




ANAEROBIC DIGESTION



- Biochemical Methane Potential tests
- Feedstock and digestate characterization
- Biogas characterization and biomethane quantification
- Batch and Semi-Continuous tests
- Pilot scale digester of 1 m³ capacity



MICROALGAE BIOMASS PRODUCTION



- Design of microalgae plant, modular systems, open ponds and paddle wheel
- Energy saving and mixing studies
- Biomass lab scale production, characterization and valorization
- Biological reactors design for heterotrophic-mixotrophic growth





RAW MATERIALS & CARBON RECYCLING

BUSINESS UNIT

MATERIALS RECYCLED



H

Hydrogen

O

Oxygen

C

Carbon

N

Nutrients

H₂O

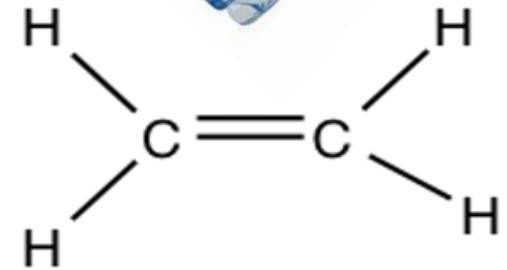
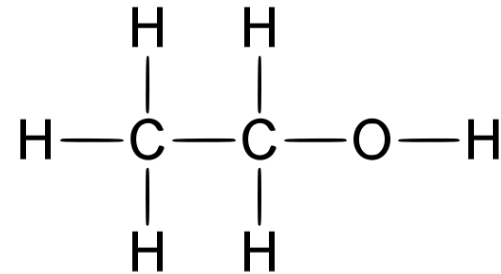
Water



- Li
- Co
- P
- Al
- Si
- Ti
- Mg



C - H - O



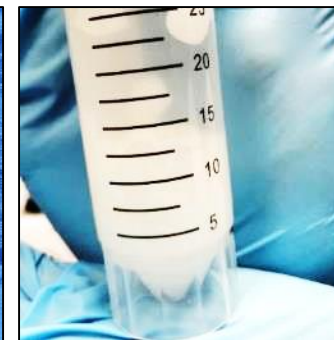
RAW MATERIALS & CARBON RECYCLING UNIT



Transforming industrial and civil waste into resources

Research lines:

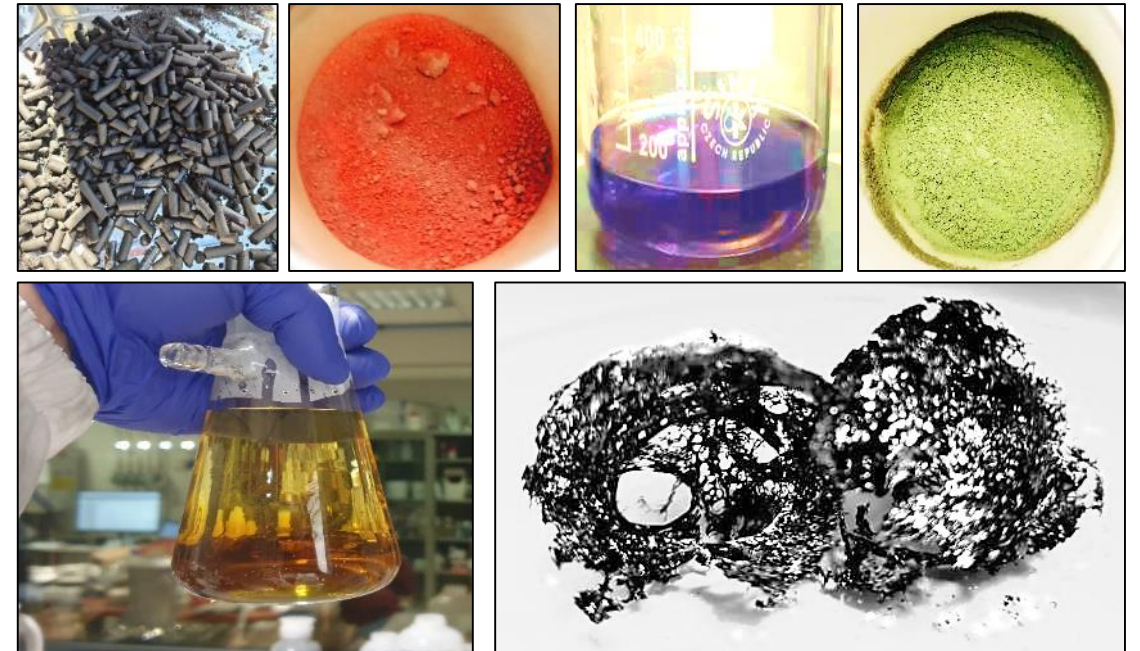
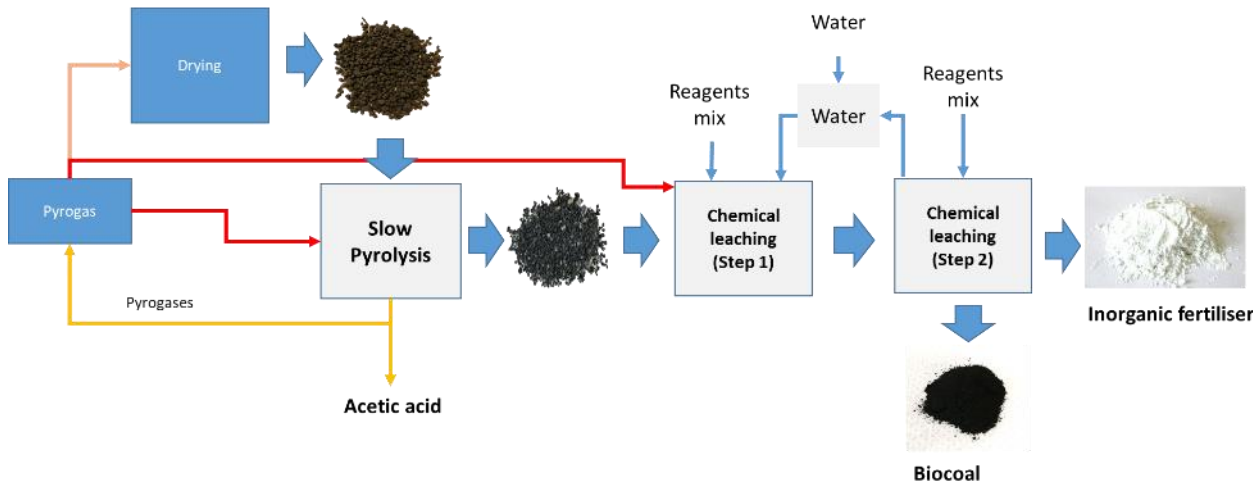
- ❖ Biocarbon from waste
- ❖ Inorganics from residual materials (P, K, Mg)
- ❖ Carbon and Aluminium from industrial waste
- ❖ Phosphorus extraction from civil sludges and wastes
- ❖ Rare metals recycling from automotive



RAW MATERIALS & CARBON RECYCLING

Most recent results:

- Patented integrated thermo-chemical process for sulphur, phosphorus recovery and biocoal production from biowaste and sludge
- Integrated recovery system for extraction of carbon and aluminium from industrial plastic waste
- Conversion of textile waste in advanced carbon materials
- Recovery of Silicon-rich carbon from sewage sludge





THANKS FOR THE ATTENTION!



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