CIRCforBIO

LIFE18 CCM/GR/001180

3rd Newsletter

JANUARY 2022

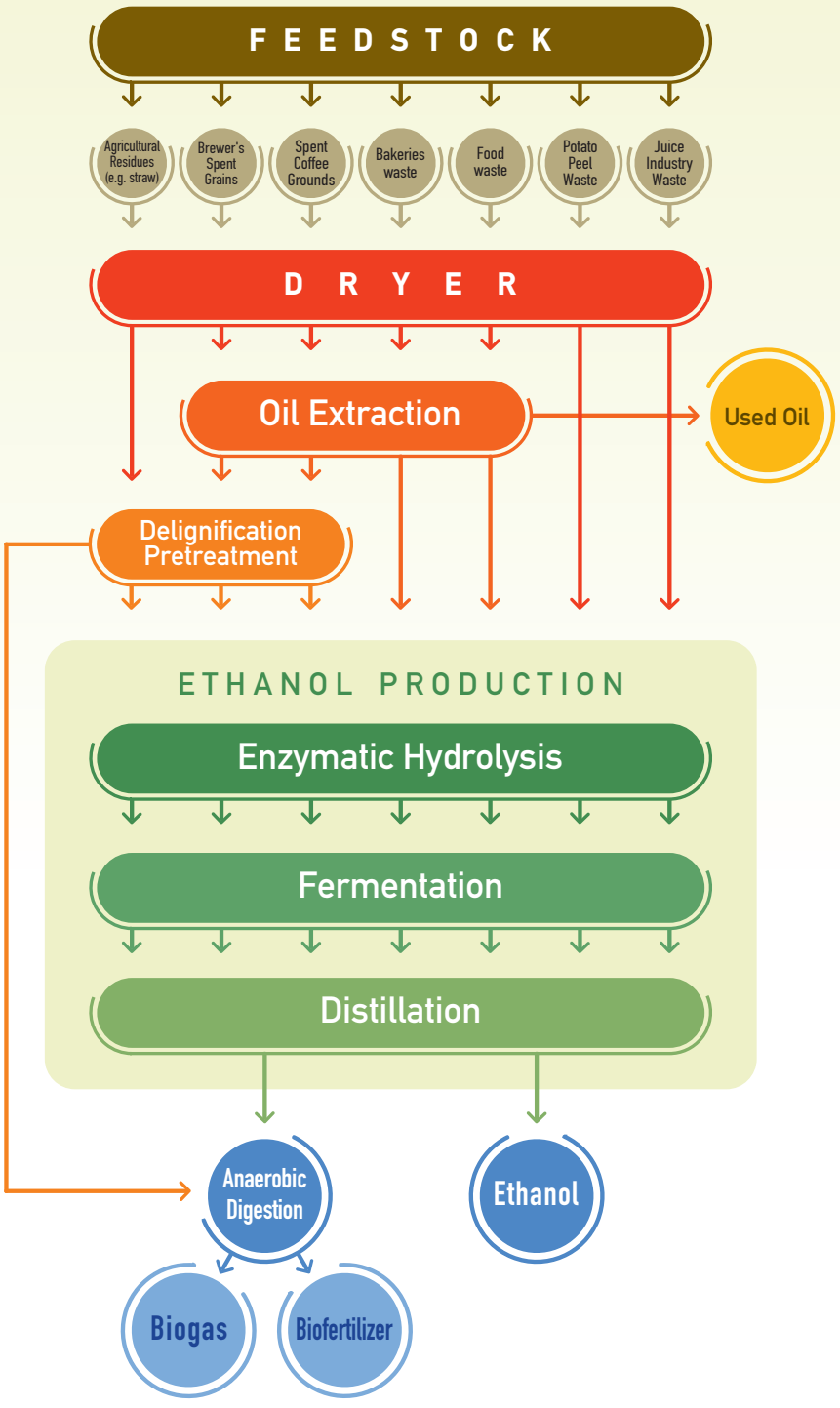
Biorefinery Concept

The biorefinery system will treat 1tn feedstock per day to produce used oil, ethanol, biogas and digestate.

The feedstock is initially pretreated thermally in the dryer unit and then directed to the ethanol production unit, where it will be hydrolyzed using enzymes then fermented by providing yeast and finally distilled.

Depending on the composition of the substrate in terms of lipids, starch and cellulose content, the feedstock can be directed to the oil extraction unit to produce used oil and can also be directed to the delignification unit for breaking down the structure of lignocellulosic materials.

The anaerobic digestor is designed for the treatment of the residues (solid and wastewater) from the upstream process train.



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Mass flow diagrams

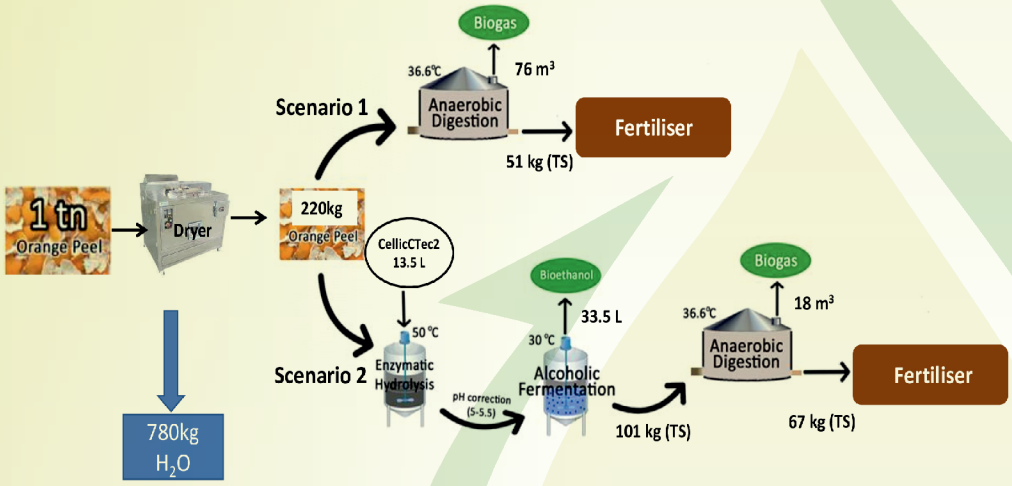
The different substrates have been analyzed in terms of their composition and properties in order to determine the treatment requirements for each type of waste biomass, namely for Food Waste, Spent Coffee Grounds, Bakery Waste, Potato Peel Waste, Brewer' s Spent Grains and Orange Peel Waste.

To this end a mass flow diagram has been developed which indicates the biorefinery process trains for each biomass feedstock under optimum conditions.

- All biomass feedstock is initially thermally treated to remove excess moisture using the dryer.
- **Orange and Potato Peel waste** are introduced either directly to the anaerobic digestion unit (Scenario 1) or to the ethanol production unit prior anaerobic digestion (Scenario 2).

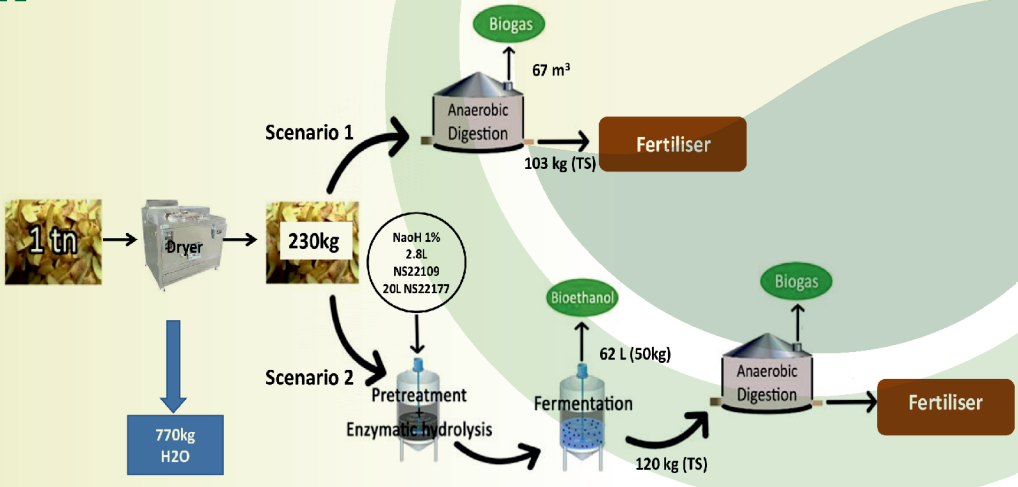
Orange Peel waste

According to the mass flow diagramm developed for the orange peel waste from 1tn, the biorefining may produce either 76m^3 of biogas and 51kg of fertilizer (Scenario 1) or 33,5L of ethanol, 18m^3 of biogas and 67kg of fertilizer (Scenario 2).



Potato Peel waste

According to the mass flow diagramm developed for the potato peel waste from 1tn, the biorefining may produce either 67m^3 of biogas and 103kg of fertilizer (Scenario 1) or 62L of ethanol, 14m^3 of biogas and 90kg of fertilizer (Scenario 2).



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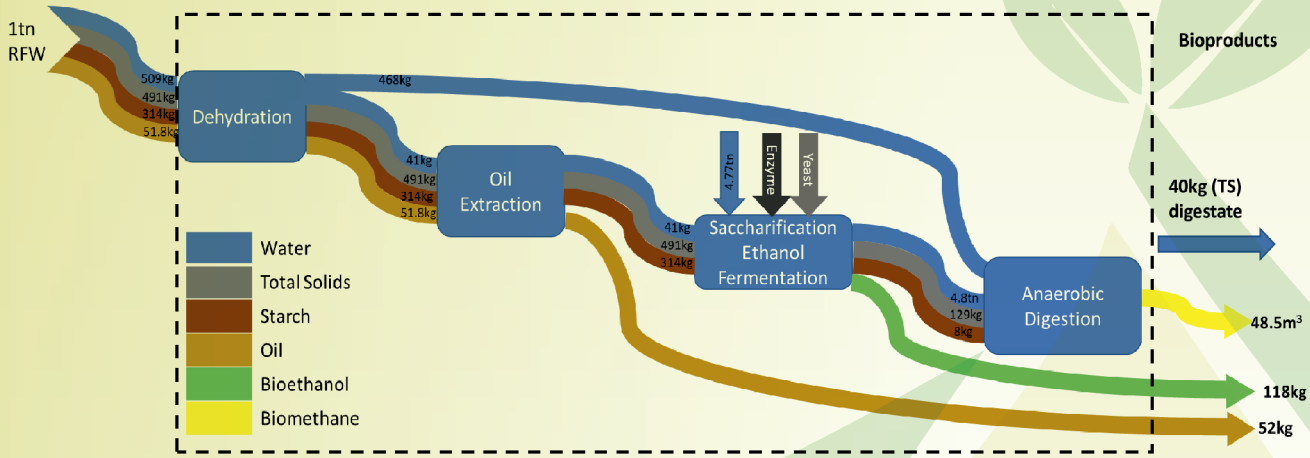
Mass flow diagrams

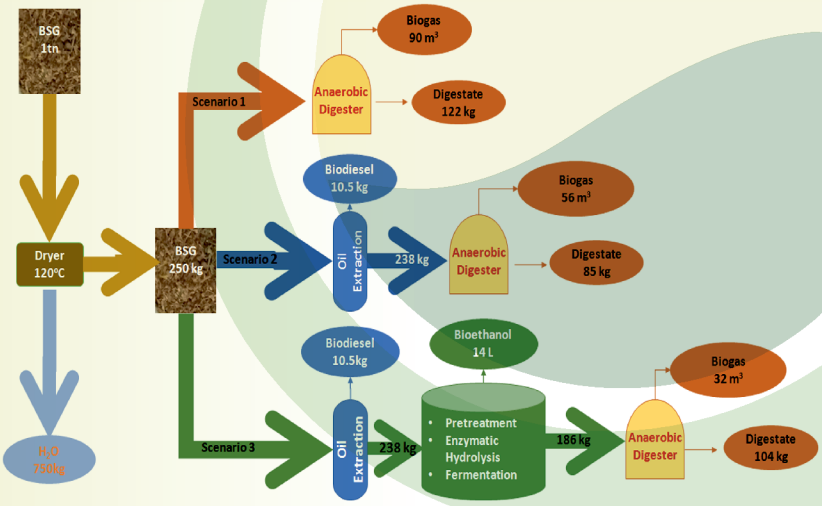
- **Food waste** is fed to the oil extraction unit and the defatted material is then treated in the ethanol production unit prior anaerobic digestion.
  According to the mass flow diagramm developed for the food waste, from 1tn of sorted food waste, the biorefining may produce around 118kg ethanol, 52kg used oil, 48,5m^3 (0,035 tonnes) CH_4 and 40kg of digestate. When added, all these products together, they represent around 20% of the input food waste.



- All treatment trains of the biorefinery system are applied for **Brewer's Spent Grainsand Spent Coffee Grounds**, namely thermal pretreatment, oil extraction, delignification, enzymatic hydrolysis, fermentation and anaerobic digestion.

Brewers Spent Grains

According to the mass flow diagramm developed for the Brewers Spent Grains, from 1tn, the biorefining may respectively produce around 90m^3 of biogas and 122kg of digestate (Scenario 1: anaerobic digestion), 10,5kg of biodiesel, 56m^3 of biogas and 85kg of digestate (Scenario 2: oil extraction and anaerobic digestion) and 10,5kg of biodiesel, 14L of bioethanol, 32m^3 of biogas and 104kg of digestate (Scenario 3: oil extraction, transesterification, delignification, enzymatic hydrolysis, fermentation and anaerobic digestion).



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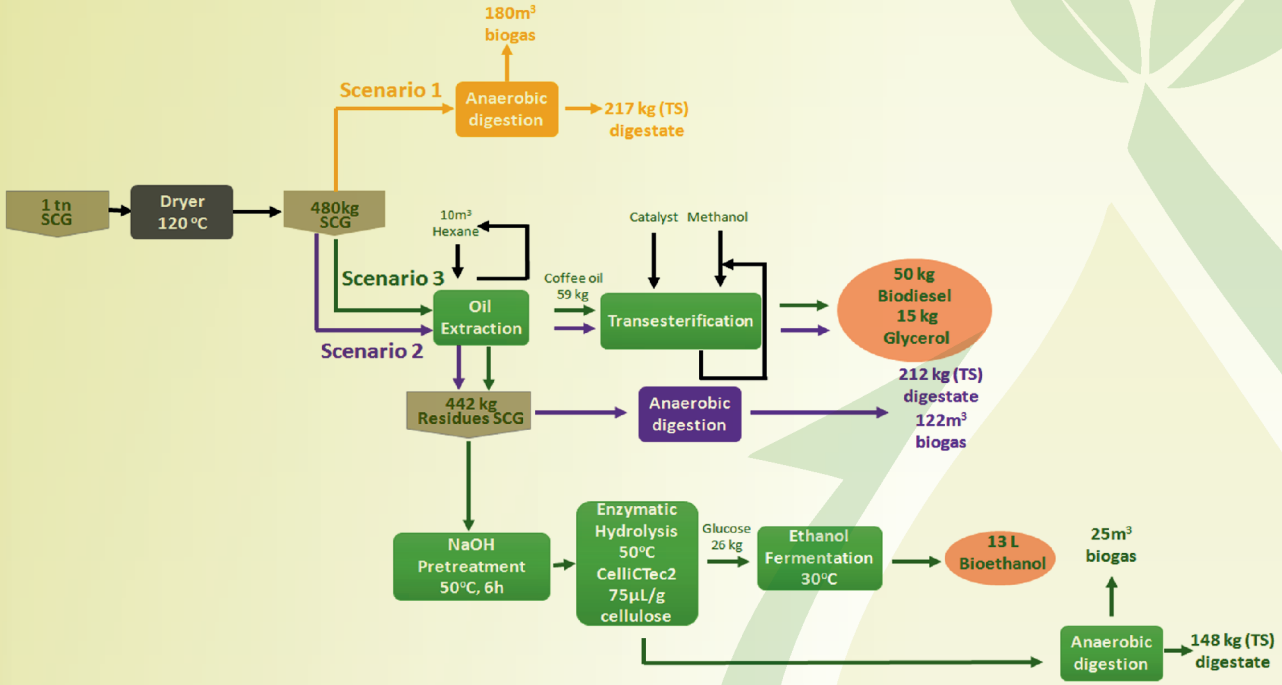
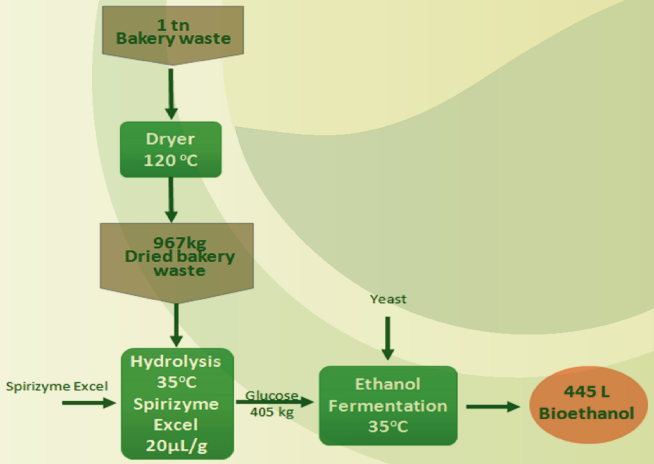
Mass flow diagrams

Spent Coffee Grounds

According to the mass flow diagramm developed for the Spent Coffee Grounds, from 1tn, the biorefining may respectively produce around 180m^3 of biogas and 217kg of digestate (Scenario 1: anaerobic digestion), 50kg of biodiesel, 16kg glycerol, 122m^3 of biogas and 212kg of digestate (Scenario 2: oil extraction, transesterification and anaerobic digestion) and 50kg of biodiesel, 16kg glycerol, 15L of bioethanol, 25m^3 of biogas and 148kg of digestate (Scenario 3: oil extraction, transesterification, delignification, enzymatic hydrolysis, fermentation and anaerobic digestion).



- Regarding **Bakery Waste**, at the present, data only for the application of the biorefinery process trains of enzymatic hydrolysis and fermenation are available. According to the mass flow diagramm developed for the Bakery Waste, from 1tn, the biorefining may produce 445L of bioethanol.



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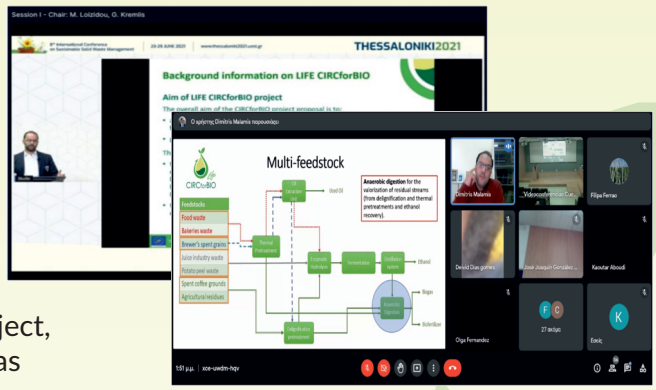
Communication and dissemination actions

Presentation of LIFE CIRCforBIO project

Dr. Dimitris Malamis (NTUA) presented LIFE CIRCforBIO project at the 8th INTERNATIONAL CONFERENCE ON SUSTAINABLE SOLID WASTE MANAGEMENT, THESSALONIKI 2021, held virtually between 23 and 26 of June 2021.



Dr. Dimitris Malamis (NTUA) presented LIFE CIRCforBIO project in the frame of the webinar series, which have been organized by LIFE BIOGASNET project, with the title "BIOGASNET Consortium experiences in biogas purification systems" and were held on the 14th and 15th of October 2021.

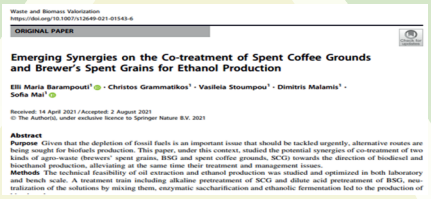
Technical Publications

The 2nd technical publication in the frame of LIFE CIRCforBIO project was released on the 10th of August 2021.


A sustainable approach to valorize potato peel waste towards biofuel production

Barampouti E.M., Christofi A., Malamis D., Mai S. *A sustainable approach to valorize potato peel waste towards biofuel production*, Biomass Conversion and Biorefinery doi: 10.1007/s13399-021-01811-4

The 3rd technical publication in the frame of LIFE CIRCforBIO project was released on the 23rd of August 2021.


Emerging Synergies on the Co-treatment of Spent Coffee Grounds and Brewer's Spent Grains for Ethanol Production

Barampouti E.M., Grammatikos C., Stoumpou V., Malamis D., Mai S. *Emerging Synergies on the Co-treatment of Spent Coffee Groundsand Brewer's Spent Grains for Ethanol Production*, Waste and Biomass Valorization doi: 10.1007/s12649-021-01543-6

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