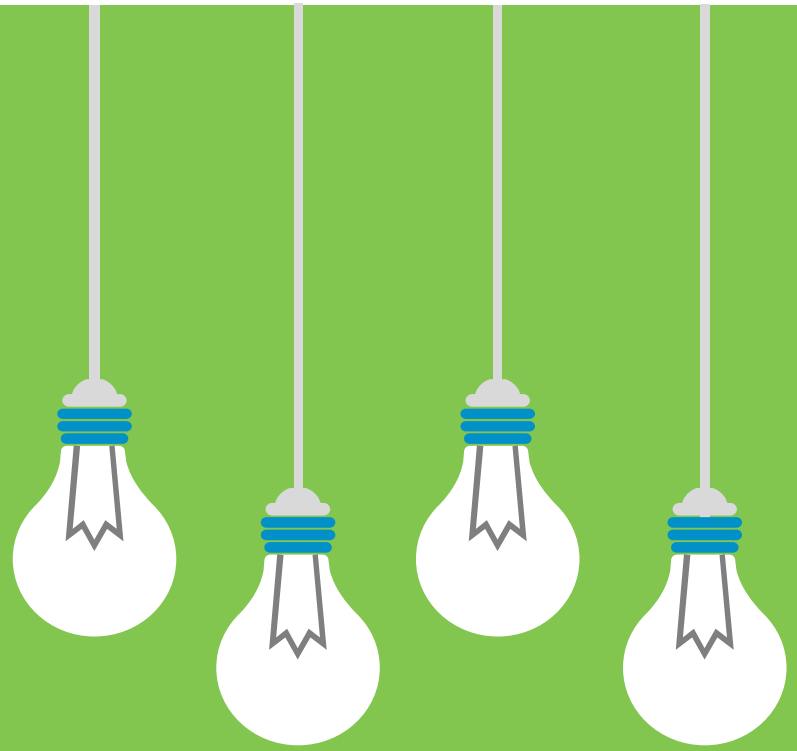

CLEAN
ENERGY

PROBLEM

Thousand tons of milk are wasted each year either as the result of too much being served or discarded for being sour or past its sell-by date. The improper disposal of dairy waste is an environmental concern.



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SOLUTION

Converting dairy waste to an efficient and reusable catalyst is the ideal solution for an integrated ecosystem . Expired dairy milk is converted to to a green solid catalyst and used as a heterogenous catalyst for biodiesel production.


CO_2
CH_4
Expired Milk
ZERO CARBON

Dairy Industry

Releases of about 4 -11 million tons of dairy wastes to the environment.

At the global scale, 100000 K tons of milk were classified as “loss and waste” in 2009.

Expired fresh milk can be used as a source to produce useful products.

Project goals

01 Synthesis a green heterogeneous catalyst from milk waste

02 Produce a clean, sustainable energy.

03 Increase the country's economy

04 Obtain a clean environment

Project goals

01

Synthesis a green reusable heterogeneous catalyst

Expired milk contains a large amount of protein, minerals and elements; therefore, it can be used as a solid green heterogeneous catalyst that can be reused again.

Project goals

02

Produce a clean, sustainable energy from waste

The previously prepared catalyst was used in the transesterification process using palm oil and methanol as a solvent to produce biodiesel as a source of sustainable energy.

Project goals

03

Increase the country's economy

Biodiesel can be described as one of the alternatives that enhance energy security because of its impact on compensating some oil and gas with fluctuate oil prices world prices. Which contributes to raising the country's economy.

Project goals

04

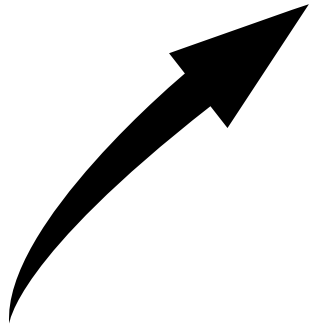
Obtain a clean environment

The use of clean energy will contribute to solve the issue of environmental pollution and help to obtain a clean environment by reducing greenhouse gas emissions. Where the environment can be preserved for future generations

Objectives of the project

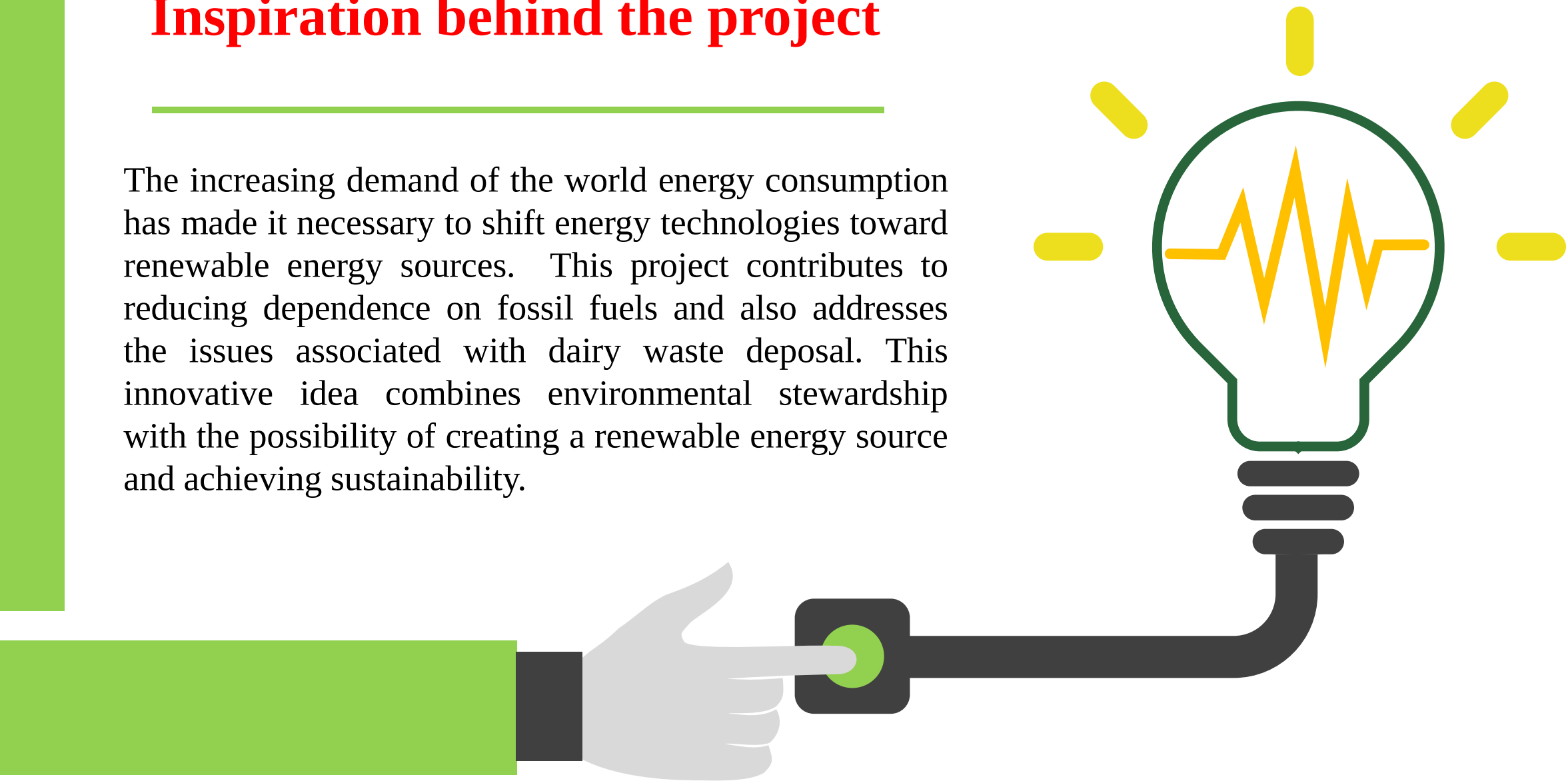
1. Extract casein from dairy waste.
2. Synthesize a green catalyst from dairy wastes for biodiesel production.
3. Characterize the synthesized catalyst using SEM, EDX and XRD.
4. Examine the influence of reaction temperature, catalyst amount, reaction time and alcohol to oil molar ratio on biodiesel product.
5. Characterize the biodiesel product using NMR, GC-MS and FTIR.

Use alternative energy to achieve zero carbon neutrality



Inspiration behind the project

The increasing demand of the world energy consumption has made it necessary to shift energy technologies toward renewable energy sources. This project contributes to reducing dependence on fossil fuels and also addresses the issues associated with dairy waste deposal. This innovative idea combines environmental stewardship with the possibility of creating a renewable energy source and achieving sustainability.



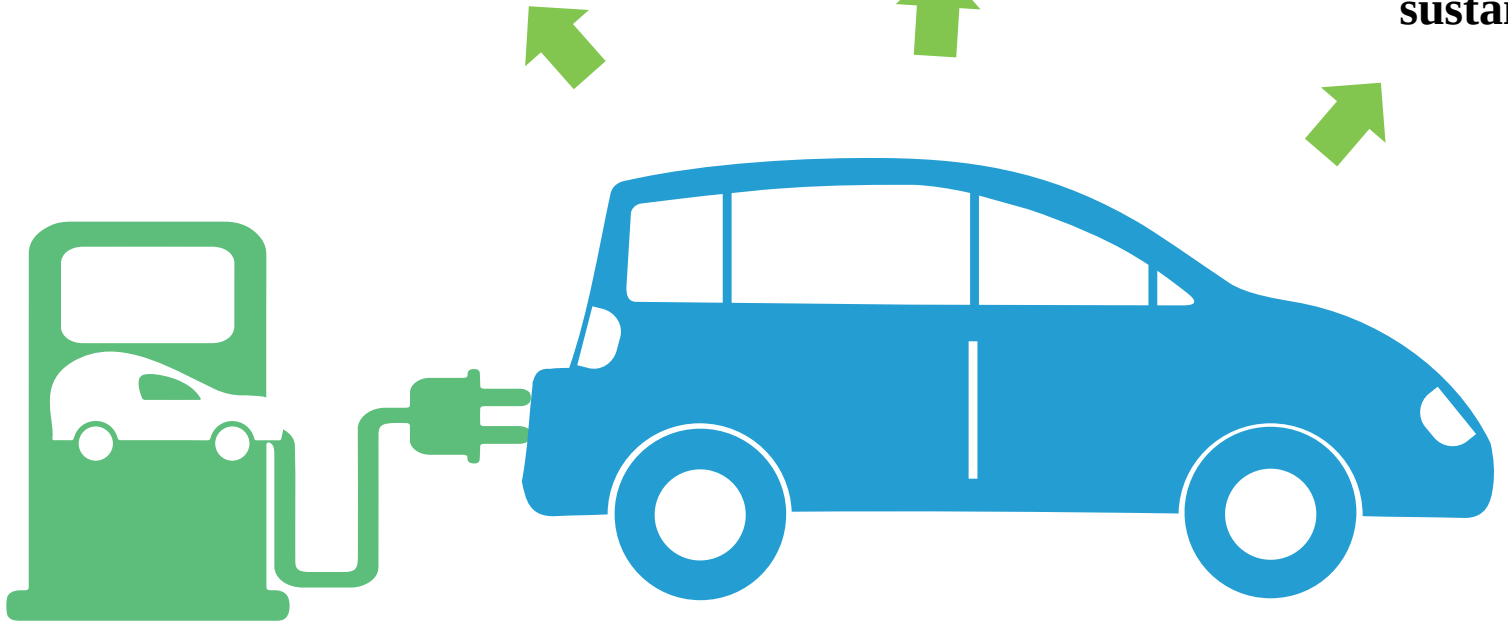
Inspiration behind the project

Converting dairy wastes to useful products will minimize the amount of generated waste and therefore protect the environment.

Eases reliance on fossil fuels

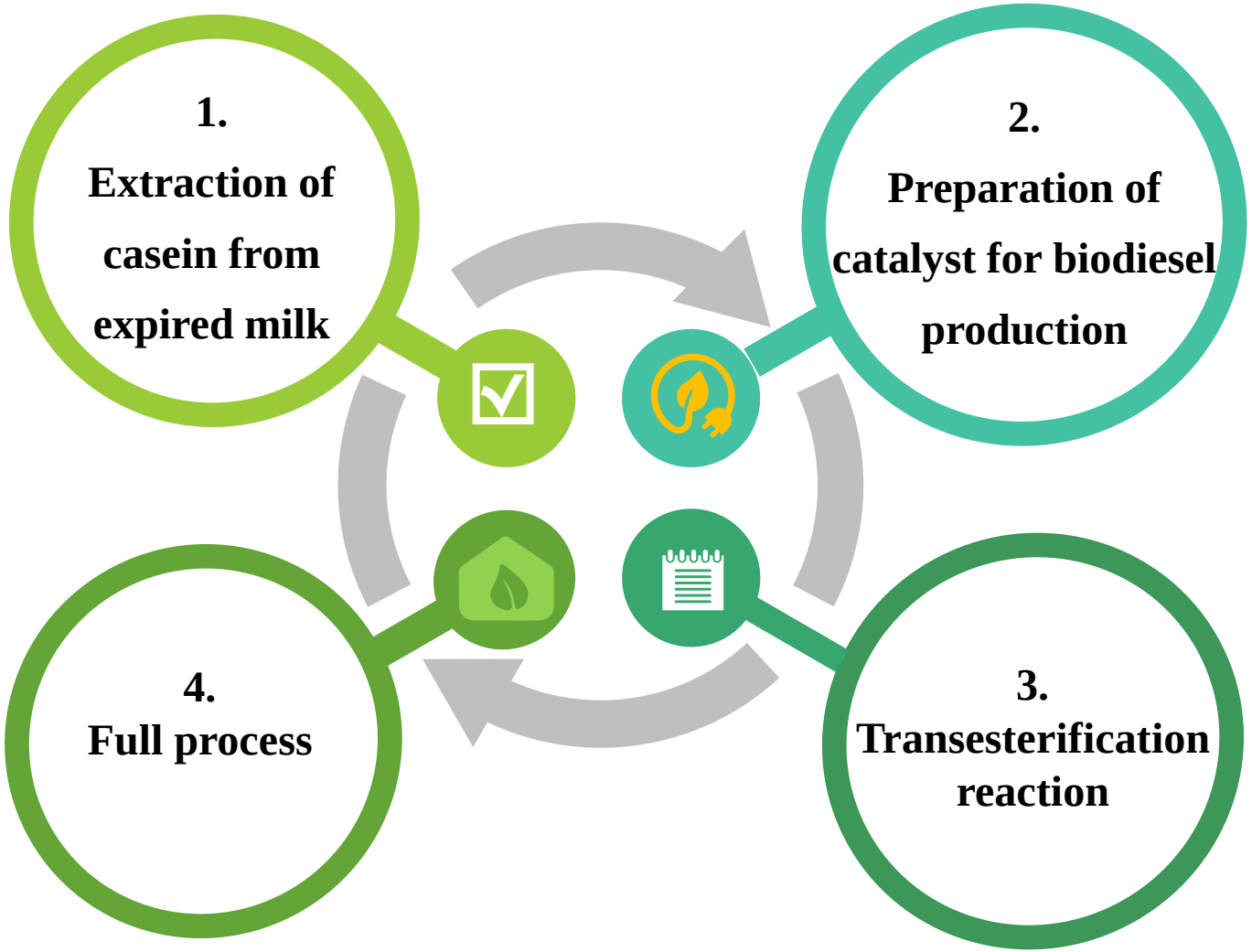
Find a renewable and sustainable energy source

Biodiesel can be used as an alternative fuel in the diesel engines

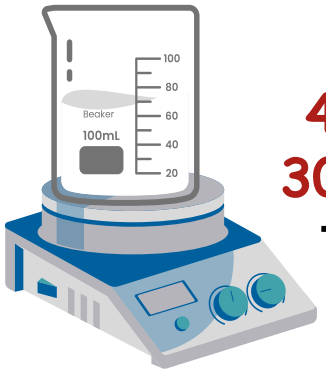


Process & Methods Followed

Process & Methods Followed

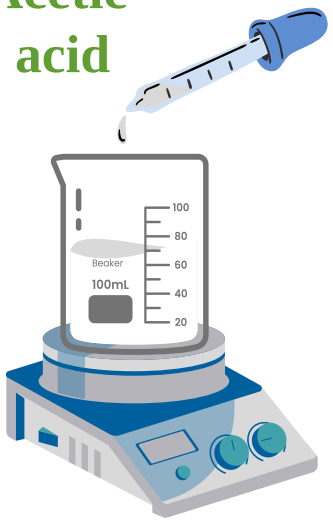


1. EXTRACTION OF CASEIN FROM EXPIRED MILK.



40° C
30 min

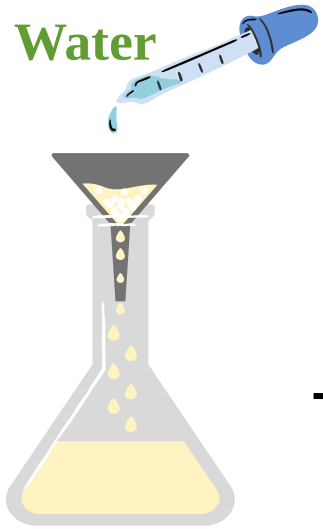
Acetic acid



Continues stirring

Whey and curd

Water

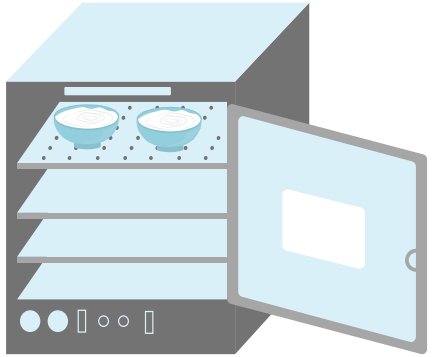


Filtration + wash with water

Curds

Dried in vacuum oven

60 C
24 hours



2. PREPARATION OF CATALYSTS FOR BIODIESEL PRODUCTION

Casein was burned and used to make the following catalysts:

MILK CASEIN CHAR

Milk casein char without any activation

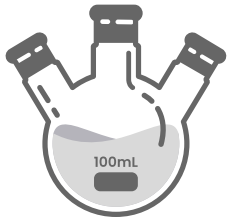
CHEMICAL ACTIVATION WITH ALKALIS SALTS

Chemical activation using different alkalis salts such as KOH, K2CO3, NaOH, and Na2CO3

CHEMICAL ACTIVATION WITH KOH WITH DIFFERENT RATIOS

Chemical activation using KOH at Carbon:KOH ratios of 1:0.5, 1:1, 1:1.5, and 1:2

3. TRANSESTERIFICATION REACTION

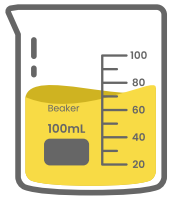


Methanol

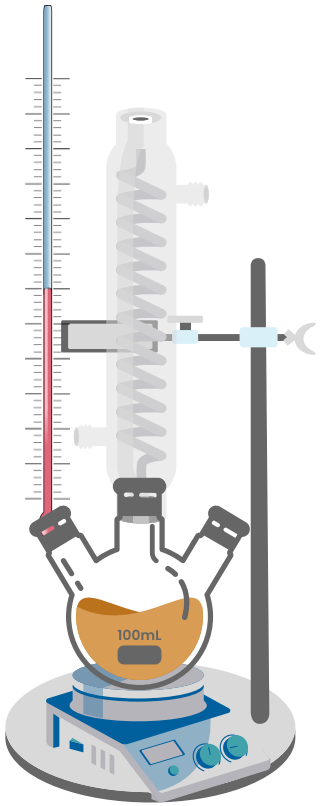
Green Catalyst obtain from milk

40min

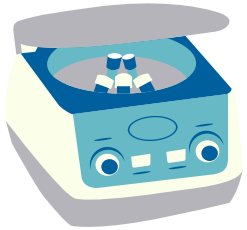
65°C



Palm oil

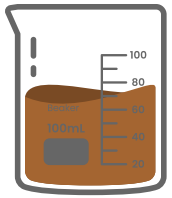


Transesterification process

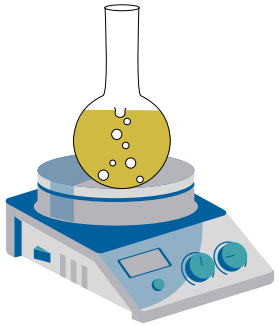


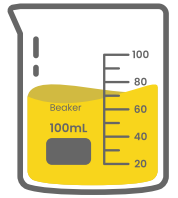
Centrifuge

Wash with water



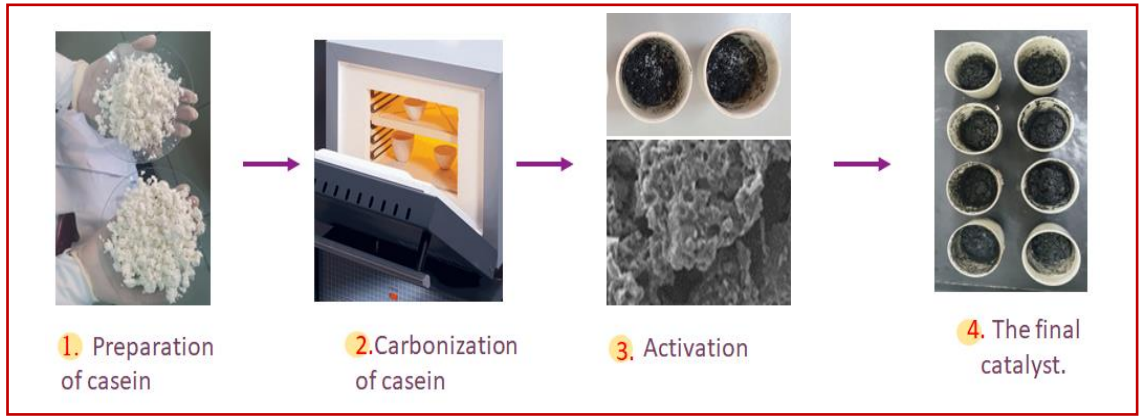
Remove glycerol





Biodiesel

4. FULL PROCESS



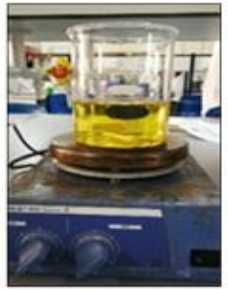
Methanol

+

Green catalyst (obtained from milk waste)

40 min

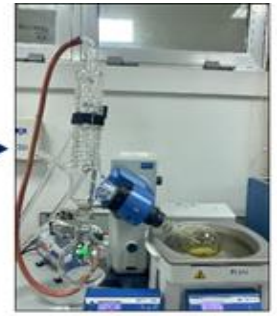
65 °C
Palm oil



Centrifuge

Wash with water

Remove glycerol



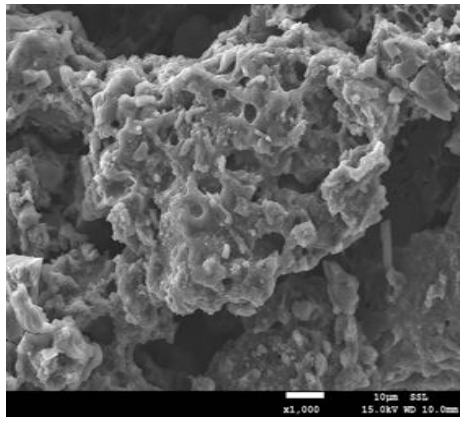
Evaporation

Biodiesel

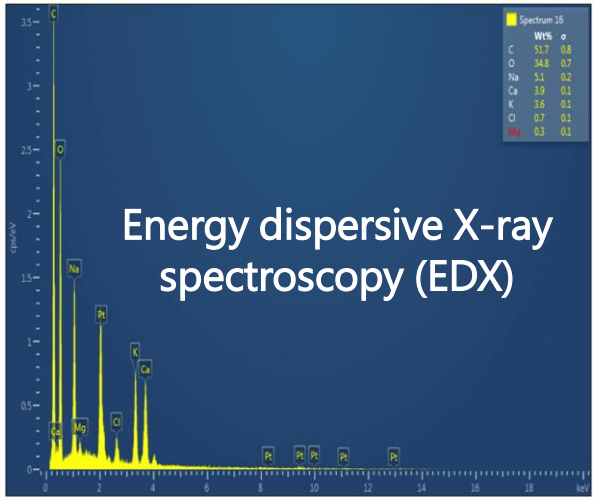
Documentation and Evidences

Catalyst Characterization

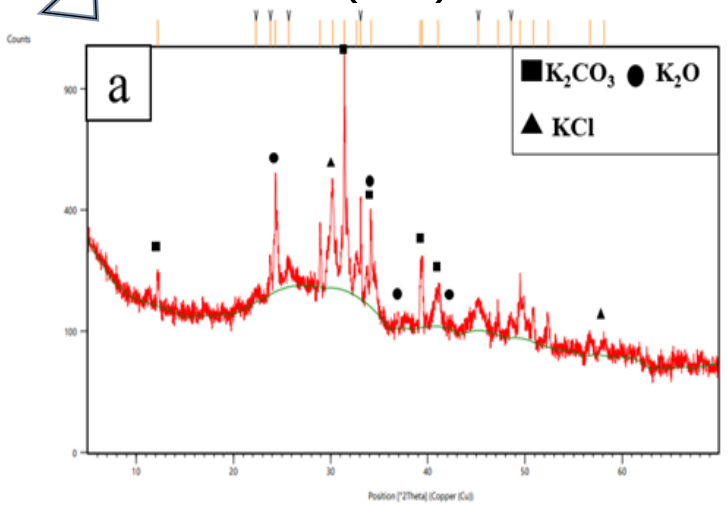
Scanning Electron Microscopy (SEM)

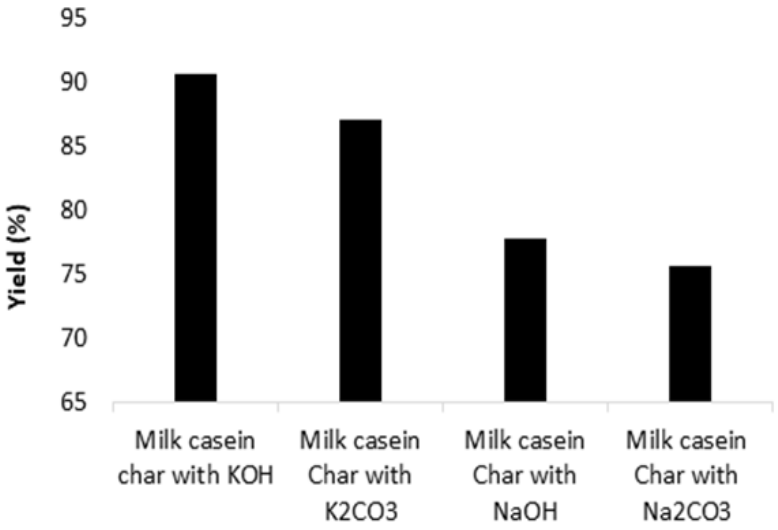


Energy dispersive X-ray spectroscopy (EDX)



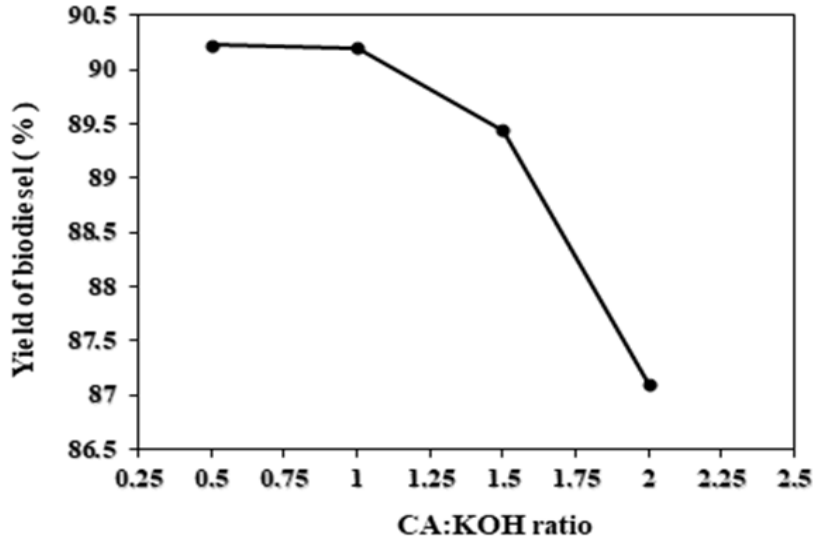
X-ray diffraction (XRD)





Casein char treated with <u>different salts</u> for biodiesel production

Selection of the optimal catalyst for biodiesel production

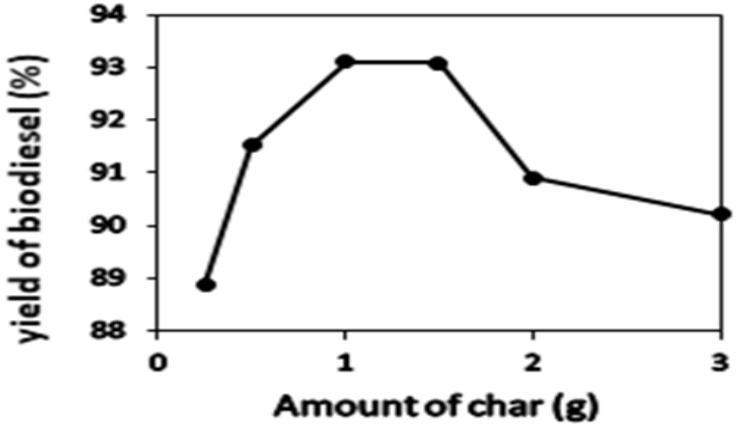


Yield with <u>different ratios</u> of char to salts

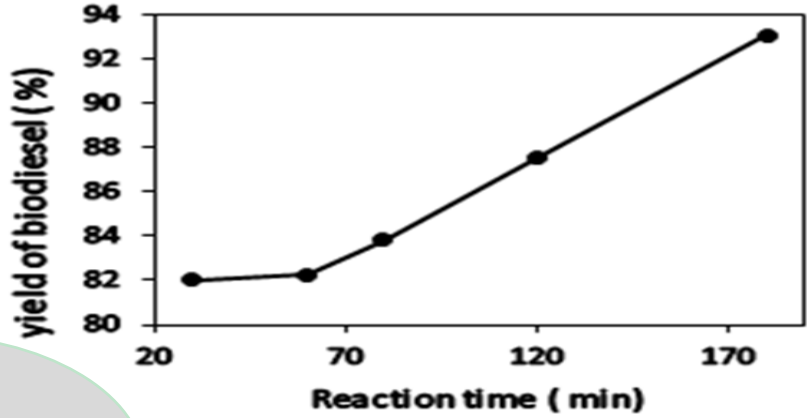
The maximum biodiesel yield was found to be 97%

Parametric study

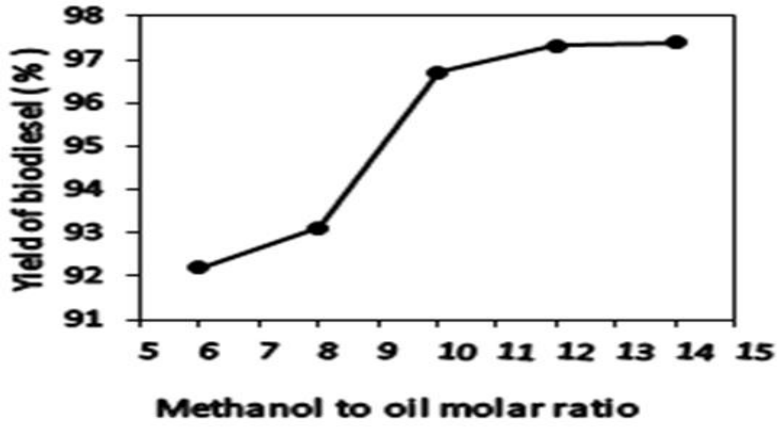
Effects of char amount



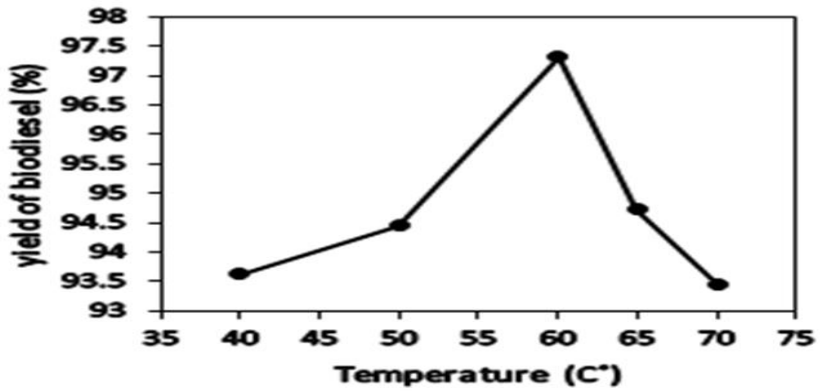
Effects of reaction time



Effects of methanol to oil ratio

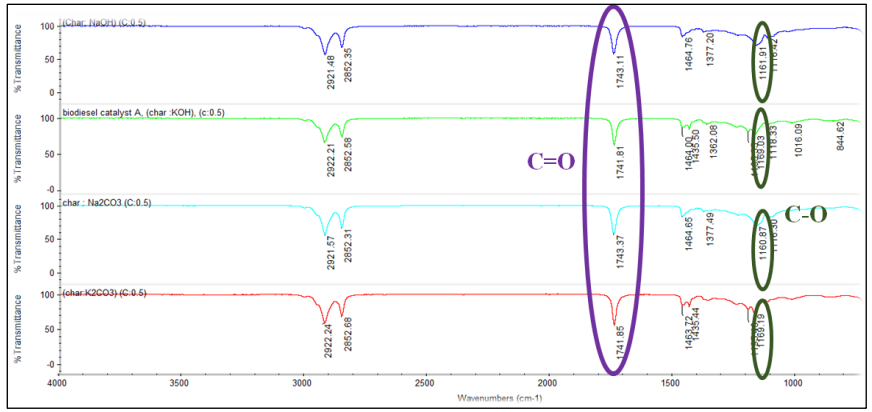


Effects of reaction temperature

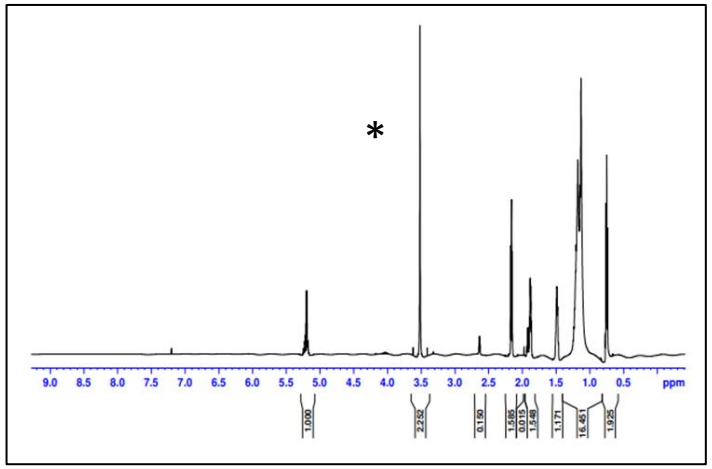


The obtained biodiesel was confirmed using GC-MS, FTIR and NMR

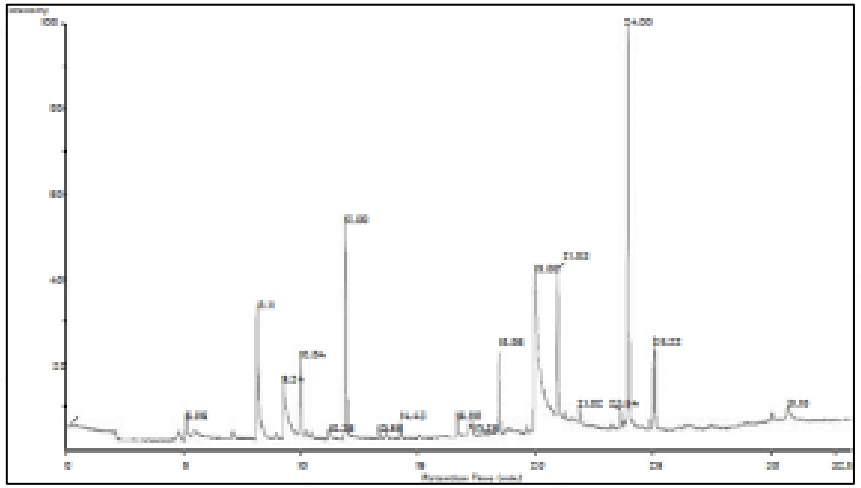
Biofuel/Biodiesel characterization



Fourier- transform infrared spectroscopy (FTIR)



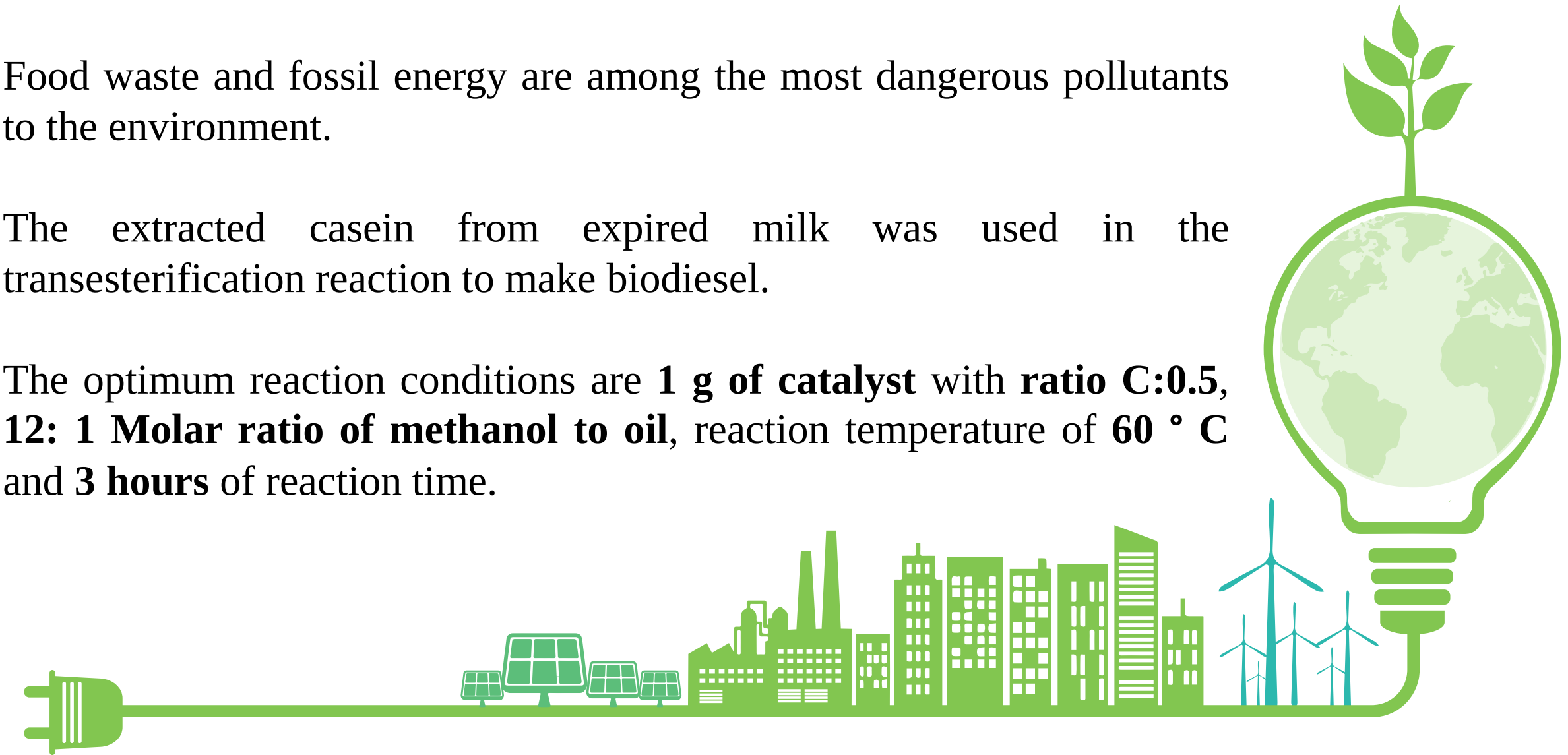
Hydrogen Nuclear magnetic resonance (^{1}H NMR)



Gas Chromatography-Mass Spectroscopy (GC-MS)

Conclusion

- Food waste and fossil energy are among the most dangerous pollutants to the environment.
- The extracted casein from expired milk was used in the transesterification reaction to make biodiesel.
- The optimum reaction conditions are **1 g of catalyst** with **ratio C:0.5**, **12: 1 Molar ratio of methanol to oil**, reaction temperature of **60 ° C** and **3 hours** of reaction time.



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Reference

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