

## Abstract

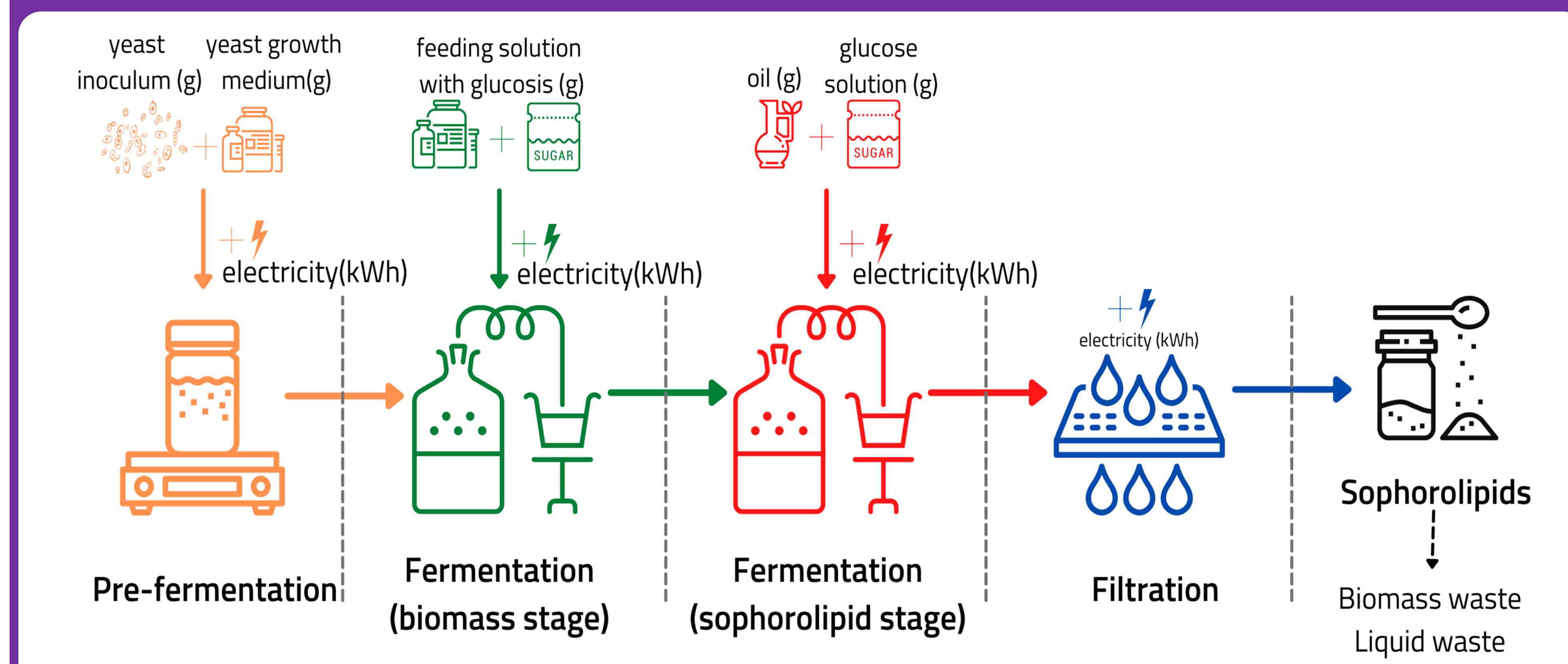
Currently, waste cooking oil (WCO) is collected and added as a substrate in biogas or biodiesel production (Liepins et al., 2021). Research shows that waste cooking oil can successfully substitute virgin cooking oil in production processes (Dahiya et al., 2018).

This study seeks to build an integrated biorefinery via fermentation process to transform WCO to sustainable biosurfactants – sophorolipids. The technology development stage majorly focusses on achieving technically viable solutions, while environmental impacts are evaluated at the process design stage.

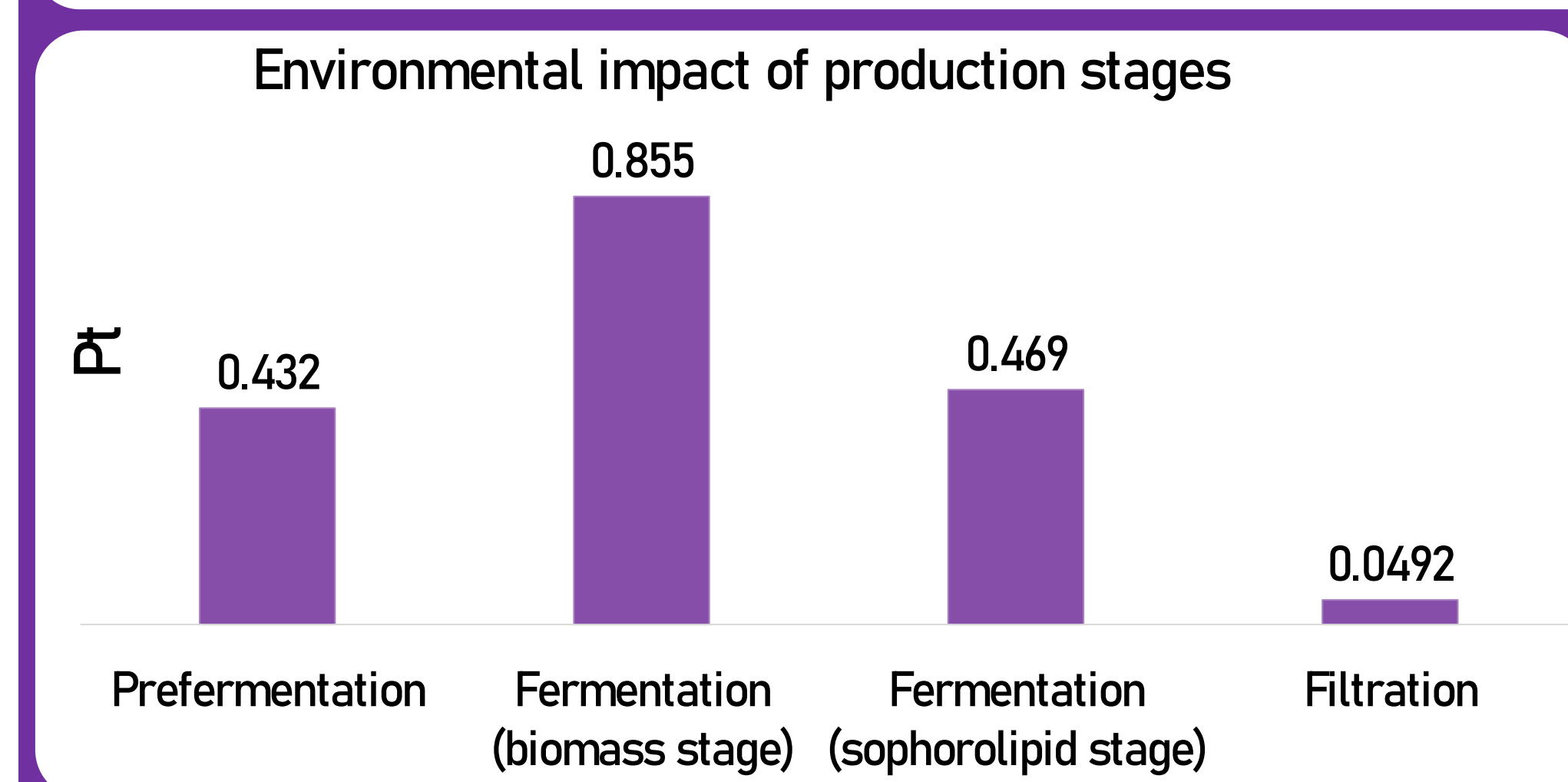
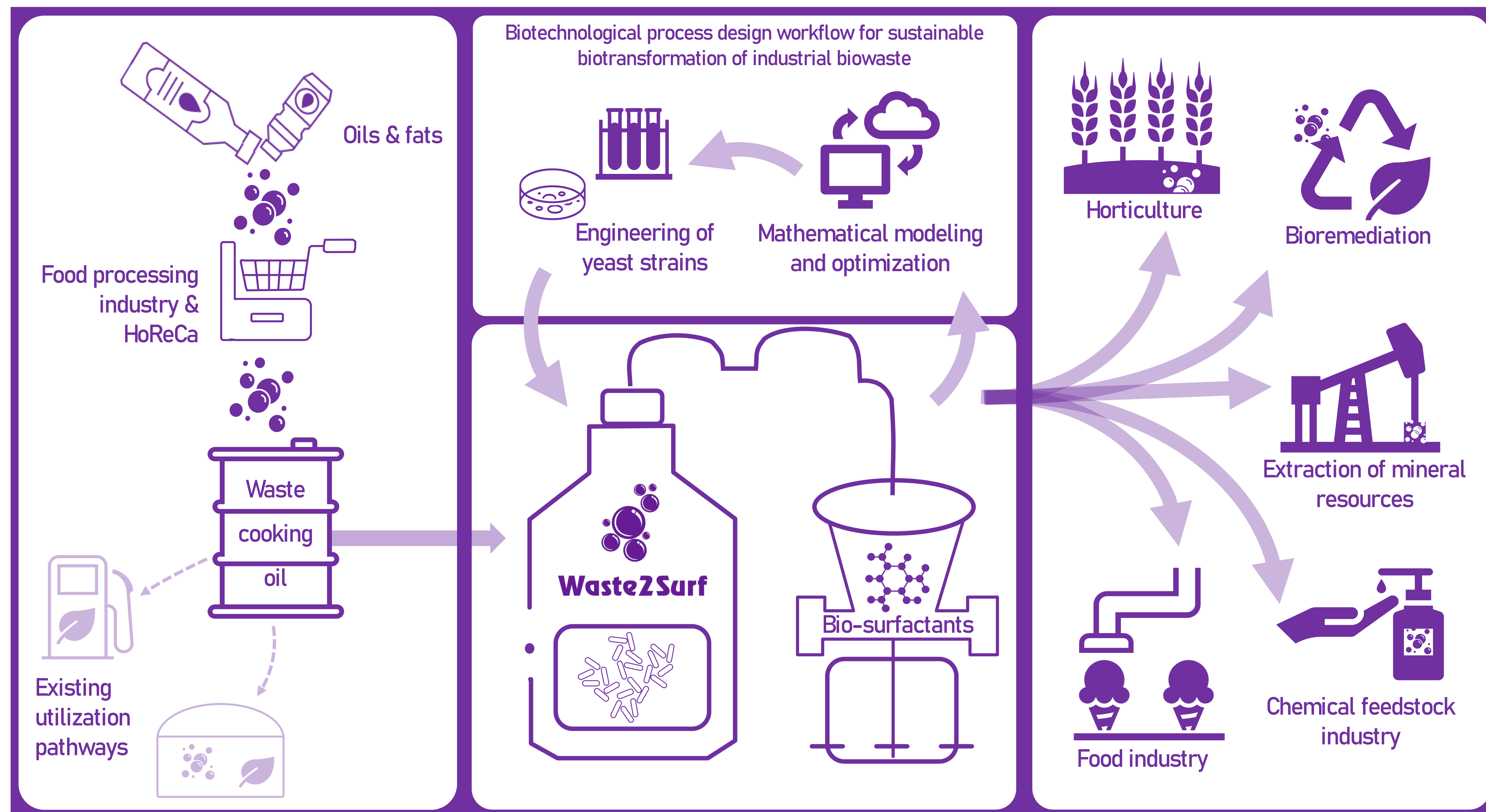
The overall objective of the current work is to develop an integrated LCA model to address the environmental performance of the existing and future biorefinery process at an early design stage along with its possible consequences in the future due to change-oriented decisions.

Information regarding mass, energy flows, and environmental losses is collected from the pilot-scale fermentation plant and translated into life cycle inventory (LCI). Additional data that are not available or difficult to determine at this stage are adapted from the Ecoinvent database.

## Oil bioconversion process into sophorolipids



## Sustainable Microbial Valorisation of Waste Lipids into Biosurfactants



Top 3 process contributions in damage categories (Pt)

	Human health	Ecosystems	Resources
Electricity	2.04	74.9	49.2
Power saving (5%)	1.94	71.2	46.8
Transport	0.0108	0.382	0.299
Glucose	0.0105	0.657	0.127
Molasses as sugar source	0.000822	0.0696	0.00653

## Conclusions

- The fermentation process was found to be the major hot spot in the sophorolipids production process and can be attributed to its higher consumption of glucose that is used as co-substrate and energy (electricity) consumed to provide temperature and mixing in bioreactor.
- Replacing glucose with other substitute like molasses has a significant reduction of global warming potential and eutrophication potential.
- Electricity consumption can be reduced by increasing the efficiency of the fermentation process. Decreased electricity consumption reduces fine particulate matter formation and fossil resource scarcity.
- Environmental benefits can be achieved by impact allocation if also co-products are used as products not as waste.

