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Divide | et | impera:

Liquid|solid|liquid solar catalysis for the full valorisation of waste cooking oil

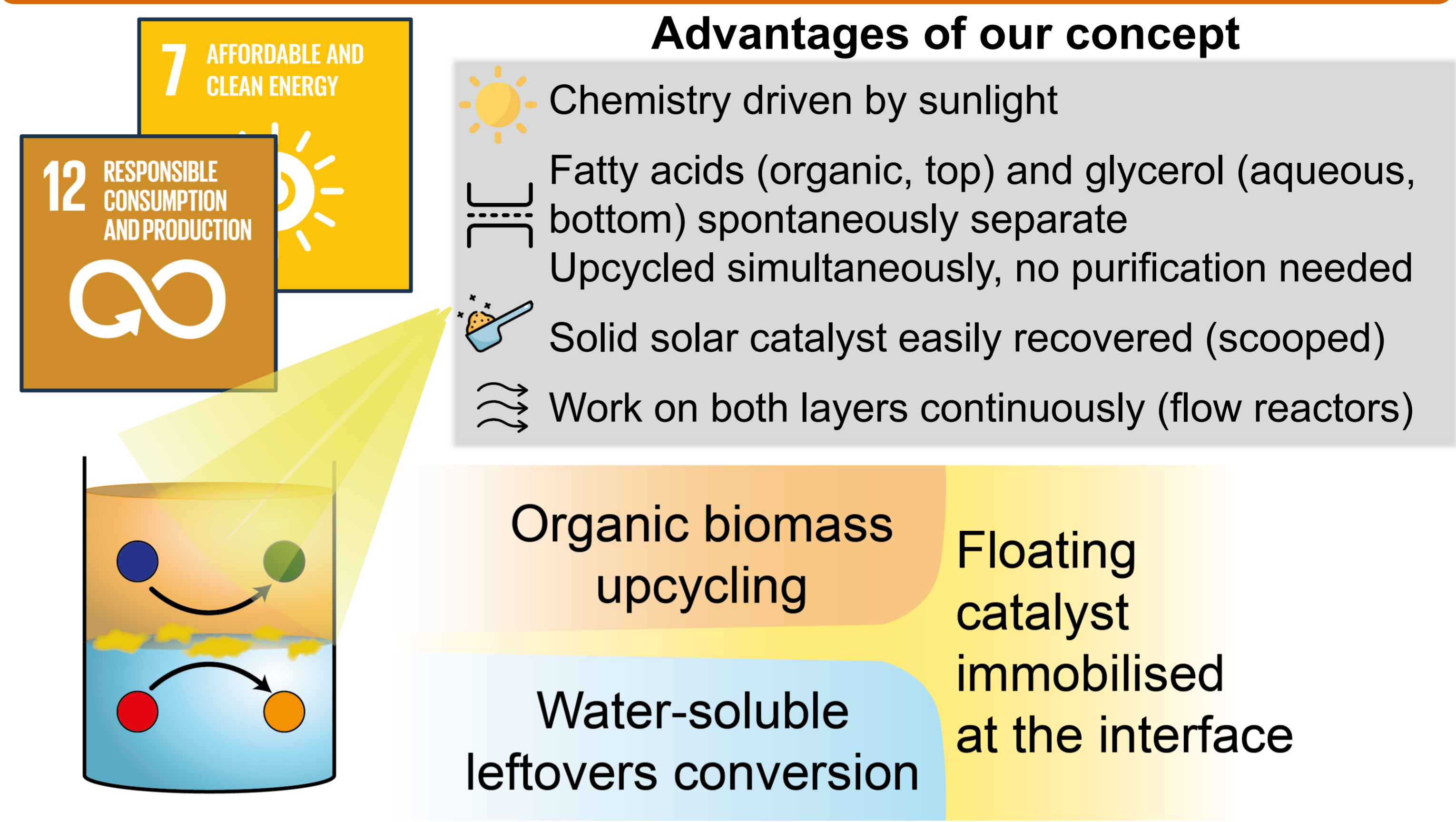
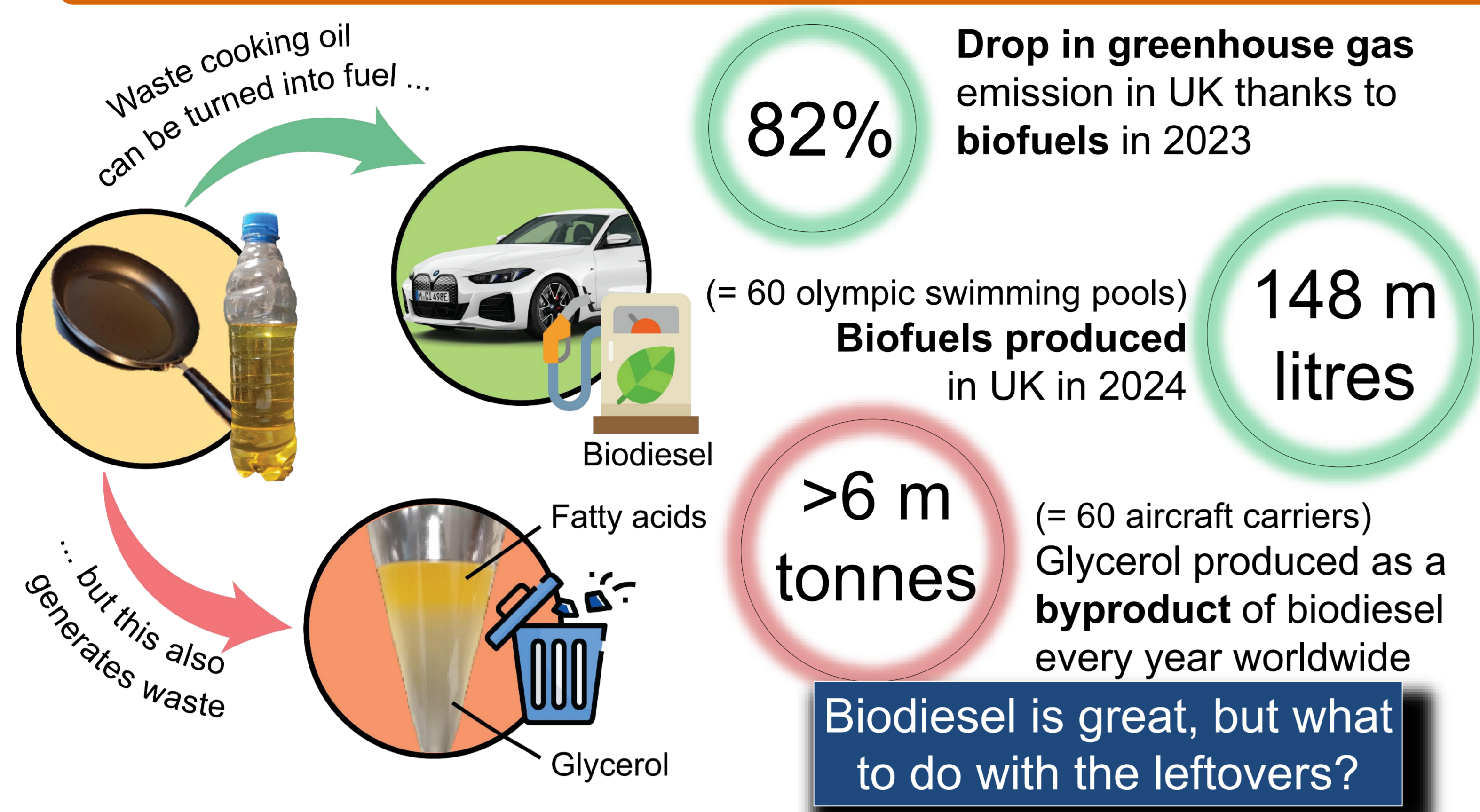
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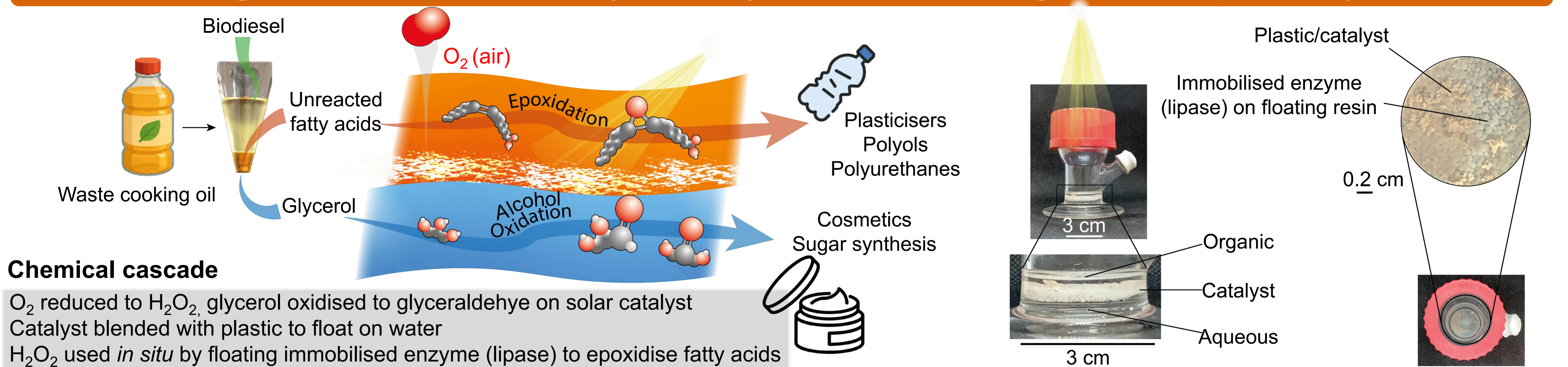


The problem: biodiesel synthesis byproducts

The solution: liquid|solid|liquid solar catalysis

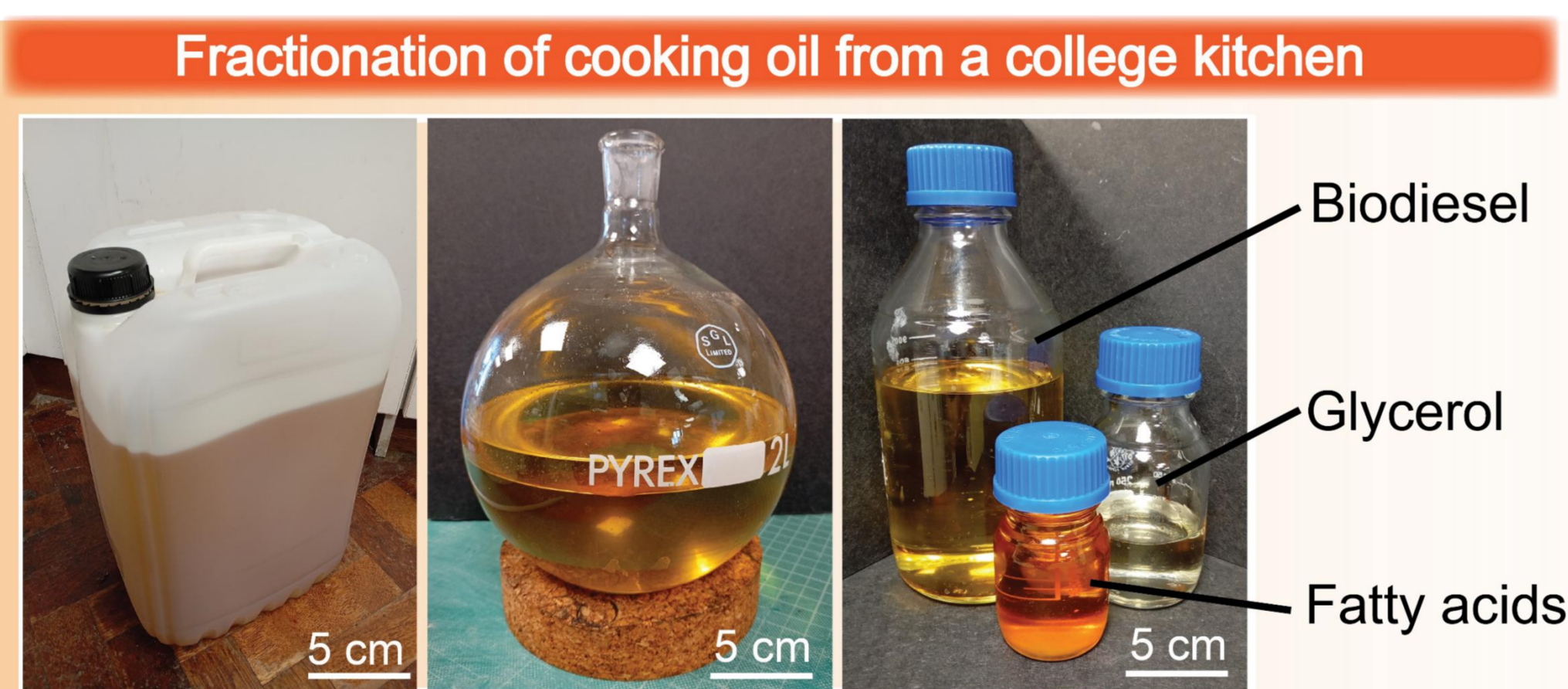


The design: metal-free solar catalyst + enzyme for cascade organic and aqueous synthesis

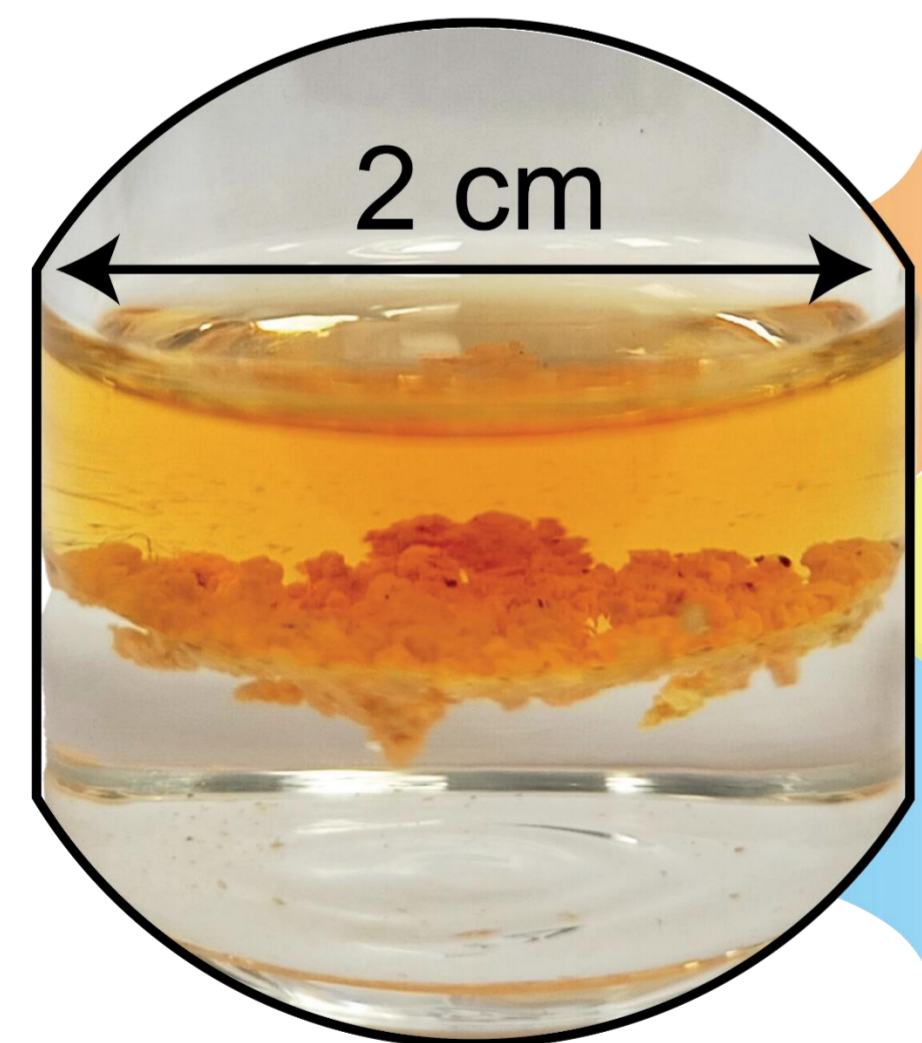
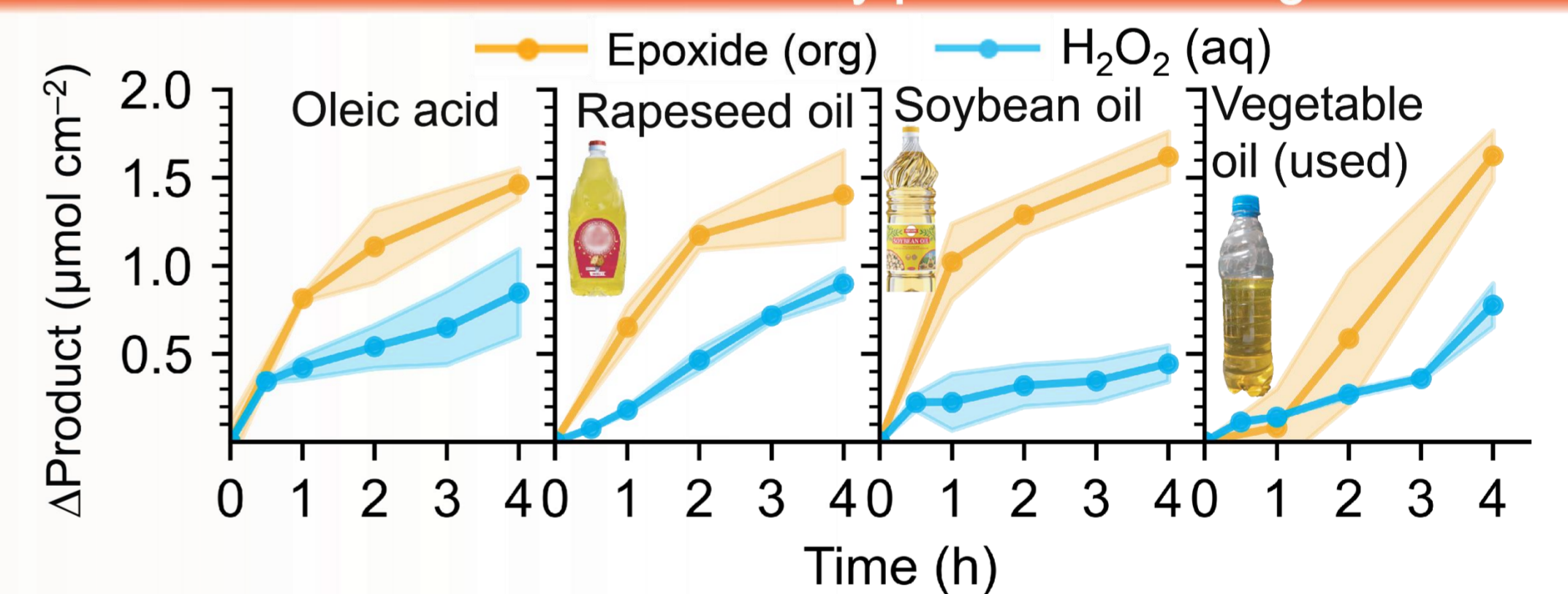


The results: solar-driven full valorisation of waste cooking oil

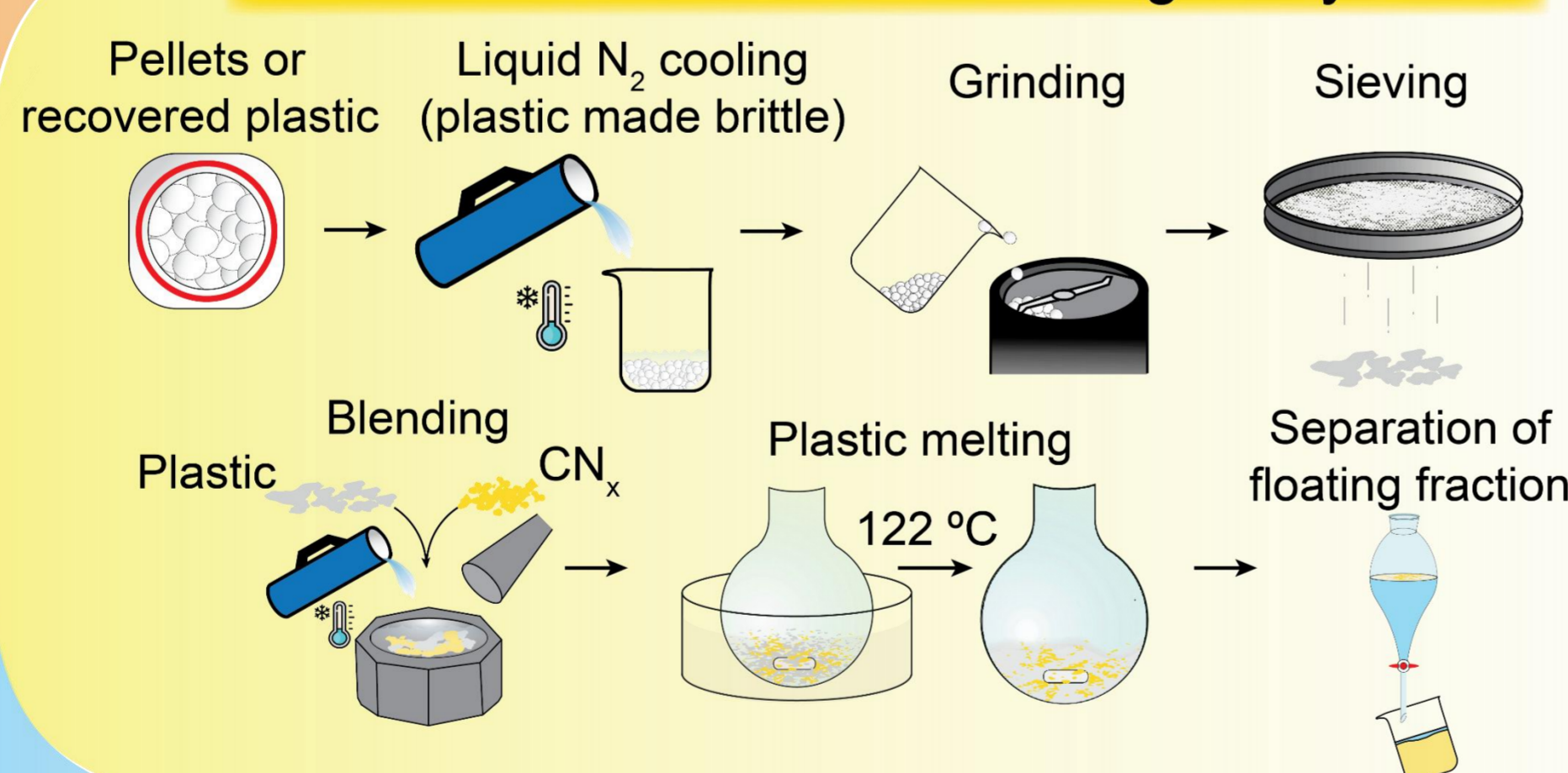
550 g biodiesel 438 g epoxides
663 g glyceraldehyde
from 1 kg waste cooking oil
in 100 mL batch reactor
under simulated solar light
in 2 days



Solar-driven valorisation of biodiesel by-products from vegetable oils



Solvent-free fabrication of floating catalyst ...



... from plastic waste



Versatile fabrication protocol working with

commodity plastic	specialty plastic
Low-density polyethylene (LDPE)	Styrene-butadiene-styrene (SBS)
Polypropylene (PP)	Polymethyl pentene (PMP)
> 45 b kg worldwide	Tyres, shoe soles, rubber
> 75 b kg worldwide	Medical devices, packaging ... and everyday consumables (bottle, cap, bag, lunchbox ...)

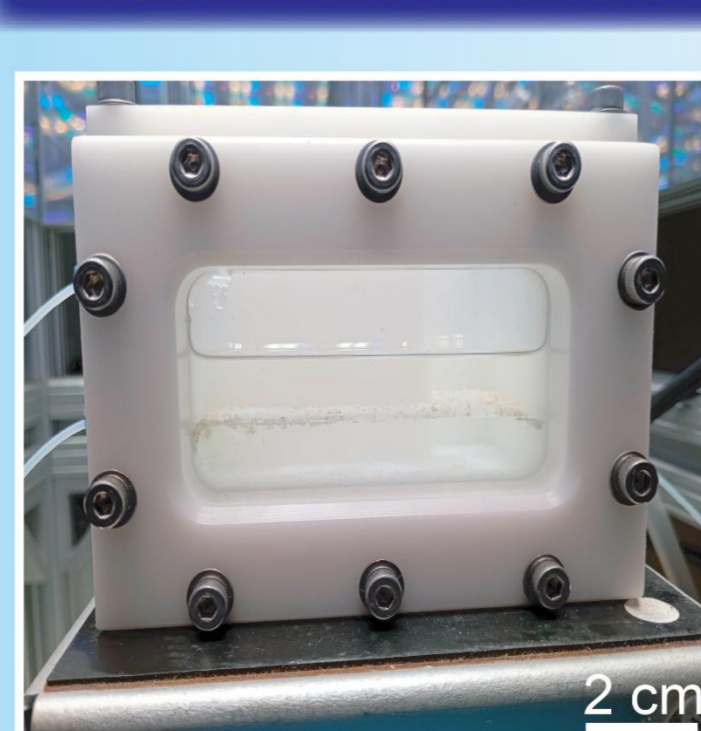
Top-down irradiated flow reactor

Organic and aqueous phases flowed, catalyst undisturbed

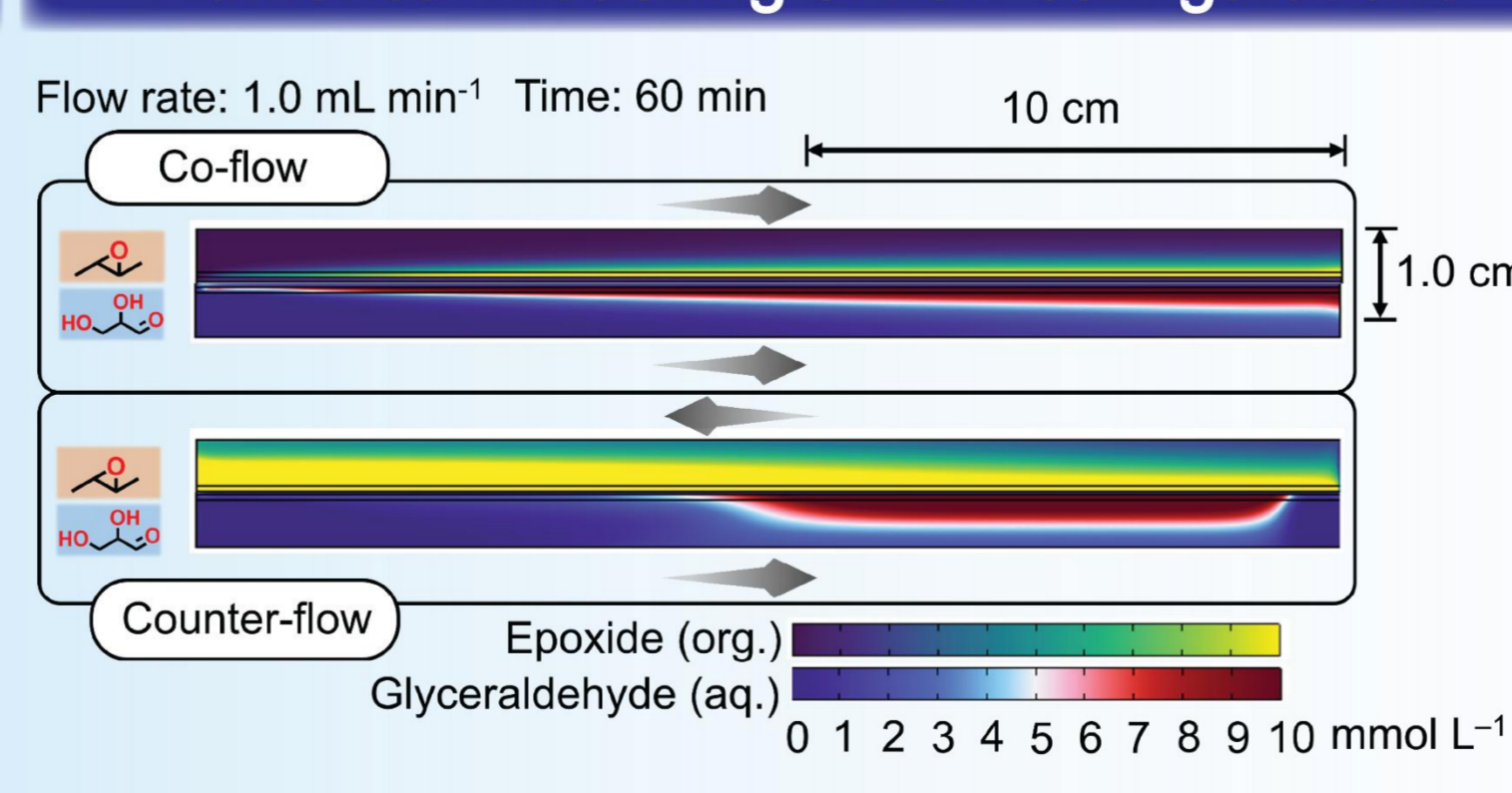
Finite element modelling simulates flow in a planar scaled-up reactor

Reaction demonstrated under real British sunlight (on our rooftop!)

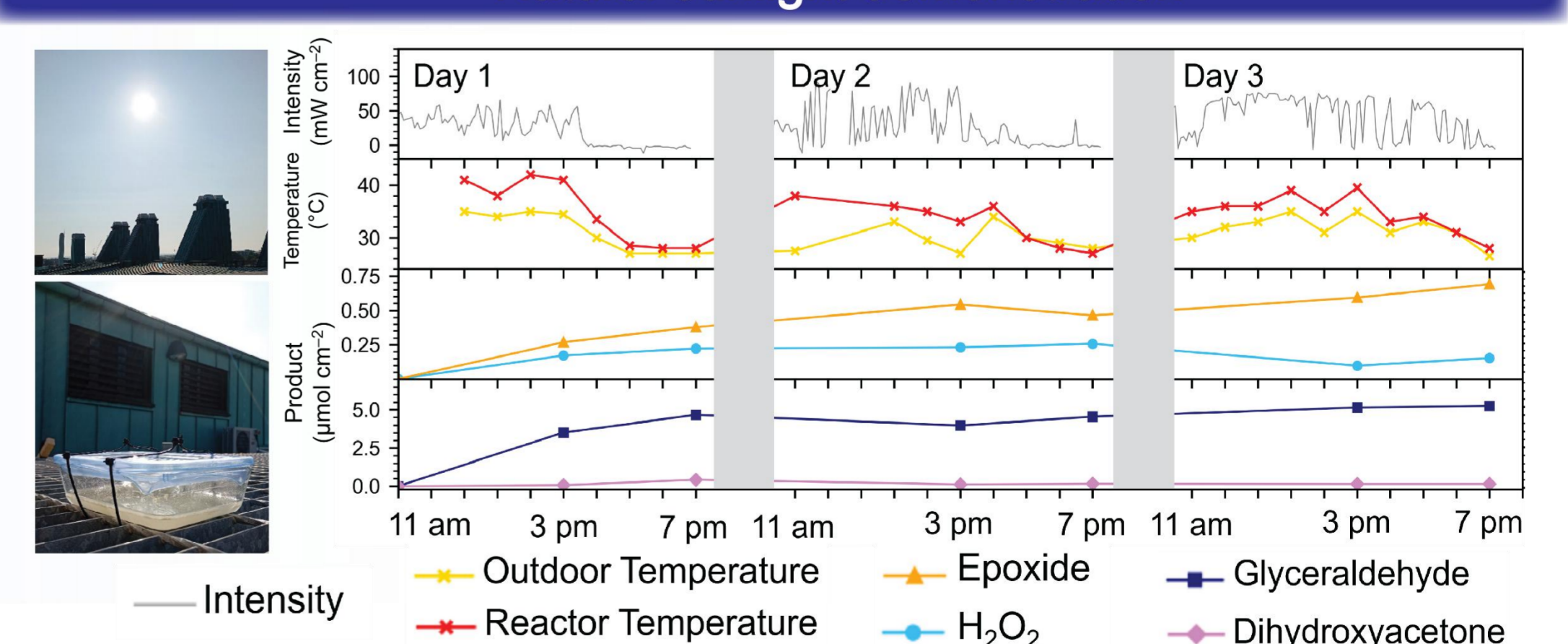
100 mL flow reactor



Numerical modelling of flow configurations



Natural sunlight demonstration



References and acknowledgements

- Rogolino *et al.* *Chem*, 2025, 102827
- "Bioenergy Crops in England and the UK: 2008-2024", Dept. for Environment, Food & Rural Affairs, UK Government



Reisner Lab

CAMBRIDGE TRUST

THREE BIRDS WITH ONE SUN : ORGANIC, AQUEOUS SYNTHESIS AND PLASTIC UPCYCLING WITH SUNLIGHT POWER