

ISUSCHEM S.R.L.
Italian **Sustainable Chemistry**



INNOVATIVE STARTUP

Fatty acids derived chemicals from waste food oils



We are a group of researchers from the Department of Chemical Sciences of the University of Naples Federico II and young local entrepreneurs who are creating a new way of doing research and production. Our activity consists in the industrial synthesis of products derived from waste oils and not deriving from crops for edible oils. These oils are part of the waste biomass which does not involve the cultivation of soils for food consumption.

The project aims to convert fatty acids deriving from waste vegetable oils into:

- ❑ **Innovative solvents** for cleaning agents, to formulate paints for printing inks, through esterification with suitable alcohols
- ❑ **Surfactants** and eco-sustainable emulsifying plasticizing agents, through appropriate functionalization of the double bonds present in the chain
- ❑ **Additives** for the formulation of cosmetics



The Project respects the principles of **Green Chemistry** and is in continuity with the development lines of the **Circular Economy**:

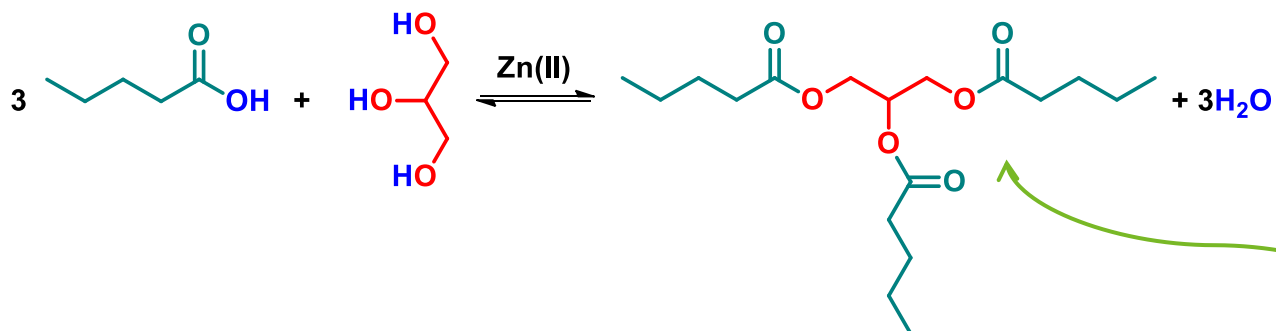
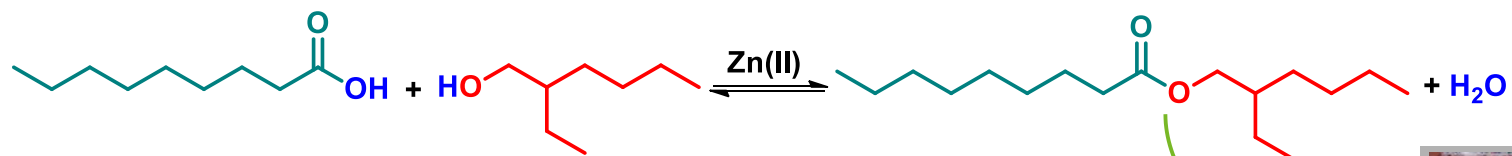
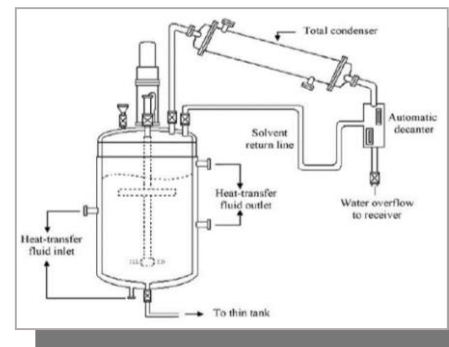
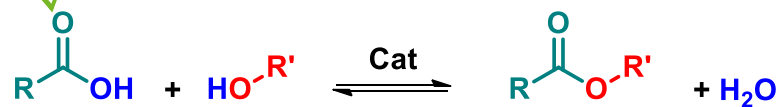
- Low E-factor**, that is the ratio between the quantity of waste per unit of product which is practically zero
- High atom economy** (molecular mass of the desired product / molecular mass of the reagents x 100%) or inclusion of all atomic species in the useful products
- Minimization of the use of solvents** and other auxiliary substances
- Use of raw materials from renewable sources.**
- Reuse of waste** raw materials in a "from cradle to cradle" approach

The industrial process of reference is based on the approach of the **waste conversion biorefinery**, or the potentially integral use of biomass for:

- Production of chemicals with high added value
- Production of fuel to meet energy needs



Industrial scale up

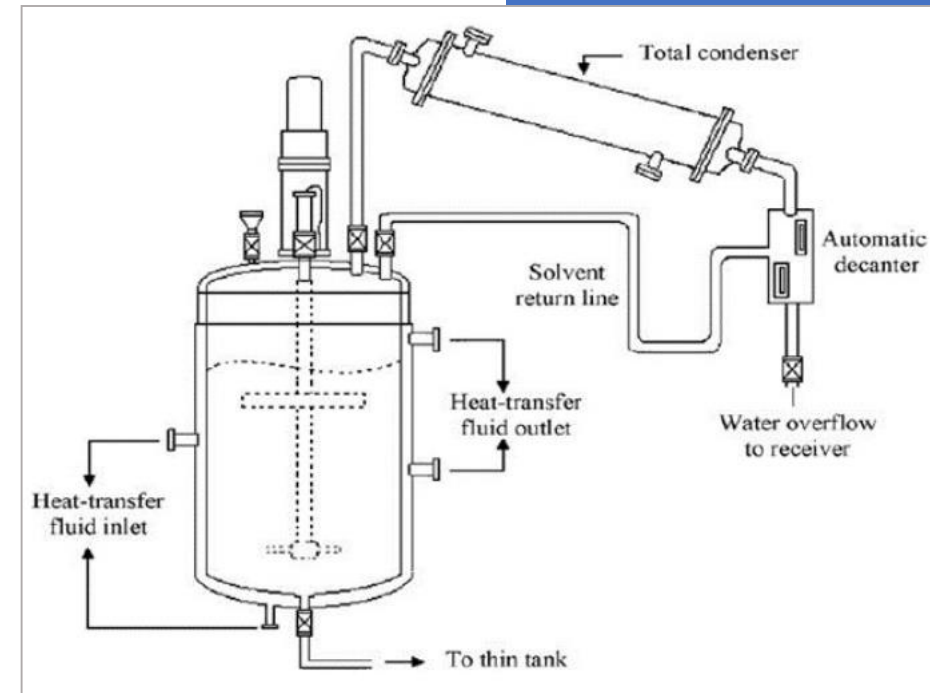


- ❑ Production will be based on the methodology of **catalysis**

The **esterification plant** will use an innovative technology (currently PCT n°WO2021149025A1), which uses a catalyst based on **zinc salts (II)**, separable from the reaction mixture by filtration and recyclable. Classical industrial processes use sulfuric acid (with the need for subsequent washing and disposal of acidic aqueous solutions).

The plant will consist of:

- ❑ A **2.5 m³ batch reactor**, thermoregulated by means of a heated jacket, and equipped with an inlet line, for all the reagents, and two outlet lines:
 - a top line for by-products (water) and unconverted reagents (alcohol);
 - a lower line for the recovery of the useful product
- ❑ A decanter for separating the non-converted reagents (alcohol) from the water (to be sent back to the feed).



Esterification Plant



A laboratory will be available to **control the quality** of the products.

Further research on **new products and process innovations** will be carried out in collaboration with the laboratories of the Chemical Sciences Department at Federico II University of Naples that carried out the research behind this initiative.

The tools available for these activities include:

- GC-MS mass spectrometry gas chromatograph
- Dynamic DLS light scattering
- GPC gel permeation chromatograph
- NMR spectrometer
- Rheometers
- Tools for the study of surface tension and emulsions
- Optical and electronic microscopes





Coating and Printing Inks

- ❑ **Major Tasks:** need to use solvents of different nature to dilute the resins used into formulations of the inks: long-chain ester-based solvents in the case of phenolic resins, or solvents of mineral origin in the case of maleic and hydrocarbon resins.
- ❑ **New Conditions:** use of a single solvent, suitable for all types of resin, with positive effects in terms of logistics and management.

Cosmetics

- ❑ **Major Tasks:** need to use emulsifiers in the production of cosmetic creams and pastes: the emulsifiers currently available are characterized by a low solvent power and a not negligible cost.
- ❑ **New Products:**
 - High efficiency emulsifier
 - Low cost



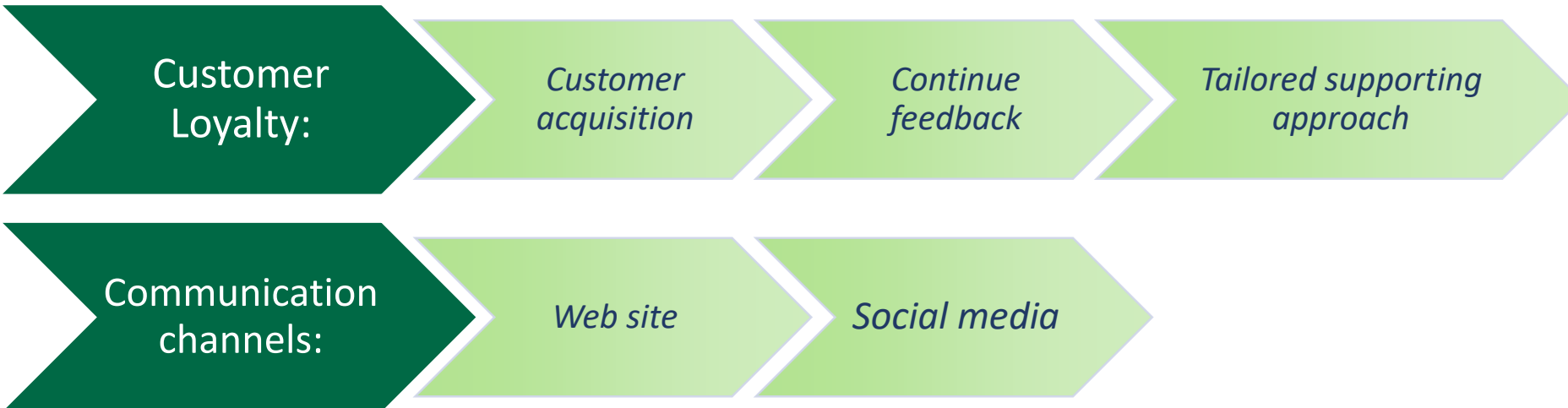
New products stay into the oleochemical market:

- ❑ Global turnover in 2018: \$ 18.920 billion
- ❑ Estimated global turnover in 2023: \$ 24.208 billion (+ 5.05% annually)
- ❑ Main market segment: Asia-Pacific region

In particular, the new products fall within the fatty acid market sector:

- ❑ World production in 2015: 11.5 million tons, mainly related to medium-chain fatty acids and oleic acid
- ❑ For fatty acid esters of the type to be produced (medium-short chain), the market is not very widespread and concentrated in the field of perfumes and herbicides





www.isuschem.it

Fb: Isuschem

LinkedIn: Isuschem

info@isuschem.it