

Energy-efficient Conversion of Castor Oil for Biodiesel Production



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INTRODUCTION

Decrease of fossil fuels reserves

Increase of crude oil prices

Environmentally sustainable design

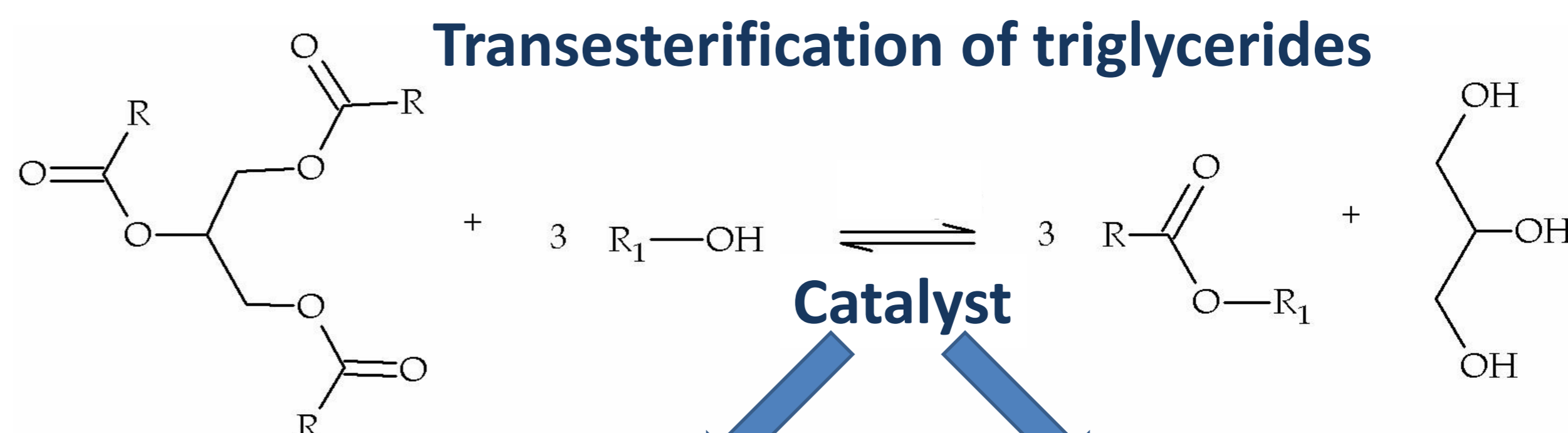
Biomass: **CASTOR**



Biofuel: **BIODIESEL**



- Renewable
- Biodegradable
- Non-toxic
- Lubricating



Acid/Base:

- Requires wastewater treatment
- Difficult glycerol recovery
- Undesirable byproducts
- Energy-intensive

Enzymes:

- High compatibility with raw materials
- Fewer process steps
- Better product separation

OBJECTIVES

Investigation of replacement of traditional chemical catalysts with enzymes for castor oil transesterification with methanol or bioethanol to produce biodiesel and glycerol.

Reuse of enzymes by recovery with ceramic membranes in a membrane bioreactor or by decanting/centrifugation.

Development of a commercially viable process with a product within ASTM biodiesel specifications.

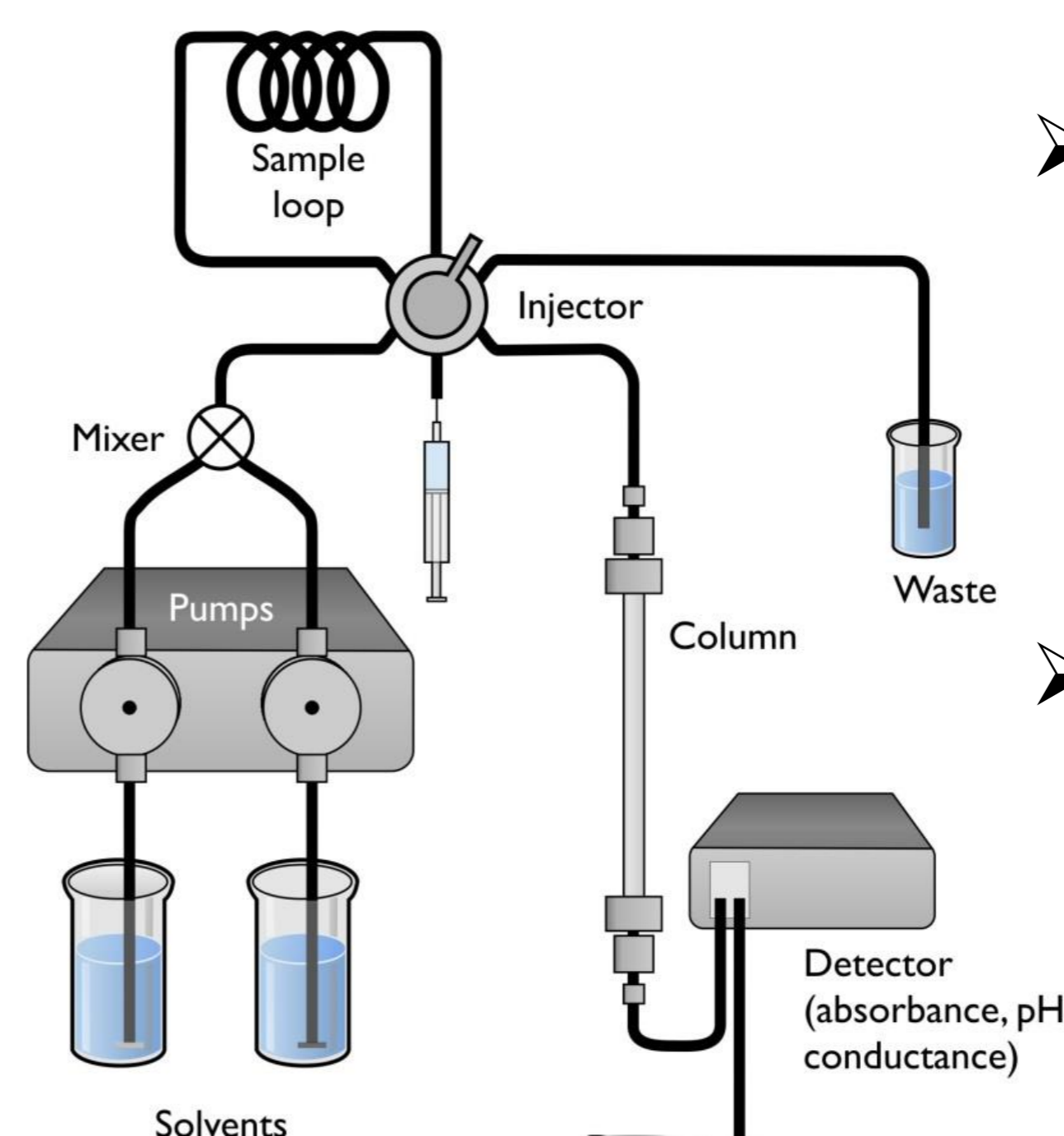
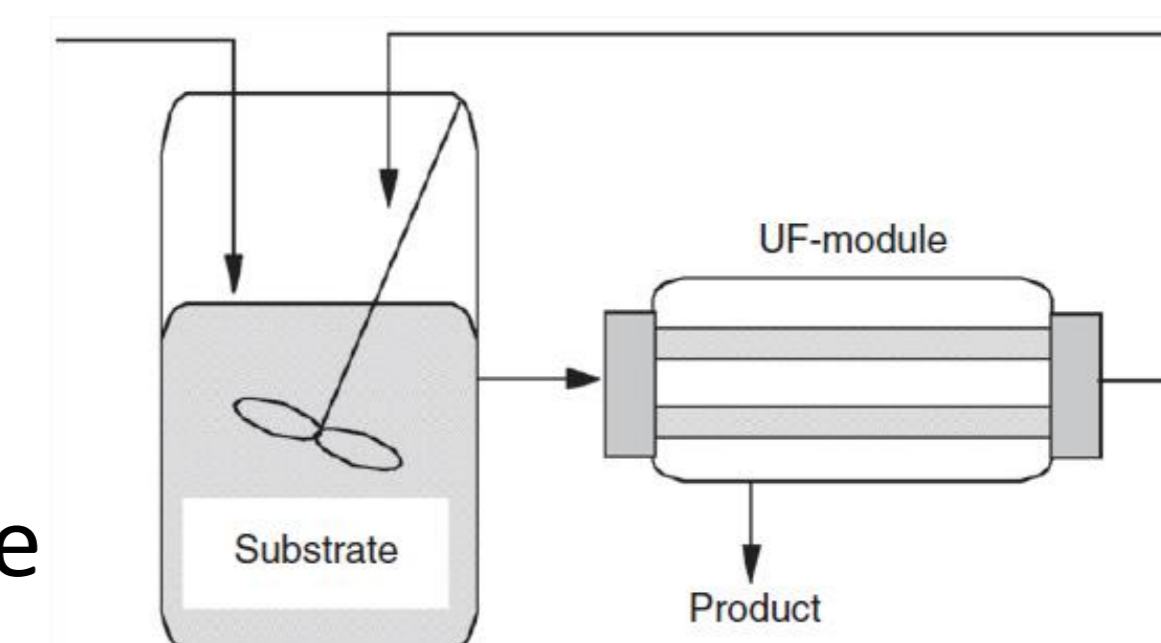
AREAS OF INVESTIGATION

- Use of different liquid enzymes to produce biodiesel, applying batch and continuous reactions
- Measurement and estimation of physical properties of the system
- Kinetic modelling by means of Matlab
- Process design based on the experimental results
- Technical and economical evaluation of the process through Aspen Plus
- Investigation of the environmental profile

METHODOLOGY

Enzymatic transesterification of castor oil to produce methyl and ethyl esters (biodiesel)

- Ceramic membrane bioreactor to recover liquid enzymes
- Batch and continuous reactor design with free enzymes using both methanol and ethanol



- Connection between membrane pore size, active enzymes, glycerol and membrane surface
- High performance liquid chromatograph (HPLC) for product analysis

- Conceptual design of the process simulated in Aspen Plus to evaluate the technical and economic performance

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ACKNOWLEDGMENTS

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