



HAL
open science

SPIRULINA EXTRACTION WITH NON-POLAR NADES: IMPACT OF COMPONENT RATIO

Mervé Yagmur, Laura Wils, Soukaina Hilali, Barbara Clément-Larosière,
Bénédicte Montigny, Johan Jacquemin, Leslie Boudesocque-Delaye

► **To cite this version:**

Mervé Yagmur, Laura Wils, Soukaina Hilali, Barbara Clément-Larosière, Bénédicte Montigny, et al..
SPIRULINA EXTRACTION WITH NON-POLAR NADES: IMPACT OF COMPONENT RATIO.
Ecole Thématique CNRS Deep Eutectic Solvents, Mar 2022, Roscoff, France, France. hal-04951874

HAL Id: hal-04951874

<https://hal.science/hal-04951874v1>

Submitted on 17 Feb 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

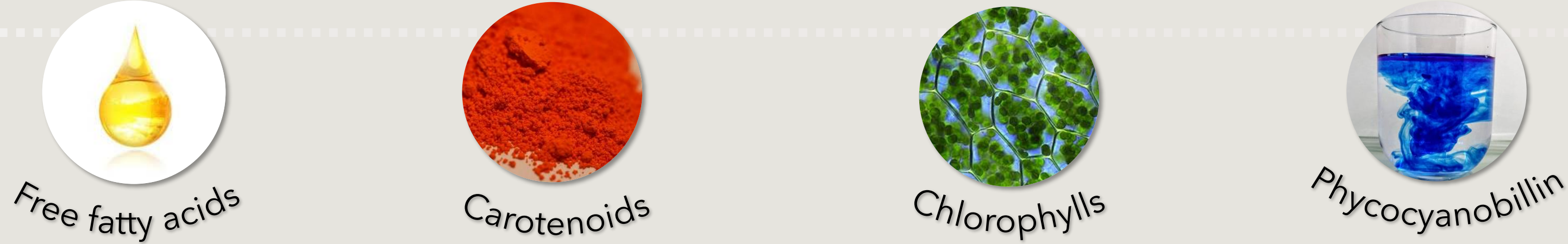
Mervé Yagmur^a, Laura Wils^a, Soukaina Hilali^a, Barbara Clément-Larosière^b, Bénédicte Montigny^c, Johan Jacquemin^d and Leslie Boudesocque-Delaye^a

^a EA 7502 SIMBA, Faculté de Pharmacie, Université de Tours, France ; ^b Aqua Eco Culture, Lamballe, France ; ^c EA 6299 PCM2E, Université de Tours ; ^d MSN Department Mohammed VI Polytechnic University, Lot 660, Hay Moulay Rachid, Ben Guerir 43150, Morocco

01 Introduction

Microalgae are a valuable source of biomolecules including free fatty acids (FFA) have anti-inflammatory, moisturizing and regulating properties, which is a highly added value for cosmetic industry.

Extraction of FFA and non-polar pigments has long required the use of organic solvents not compatible with topical application non environmentally friendly. In that case, Natural Deep Eutectic Solvents (NaDES) show many interests.



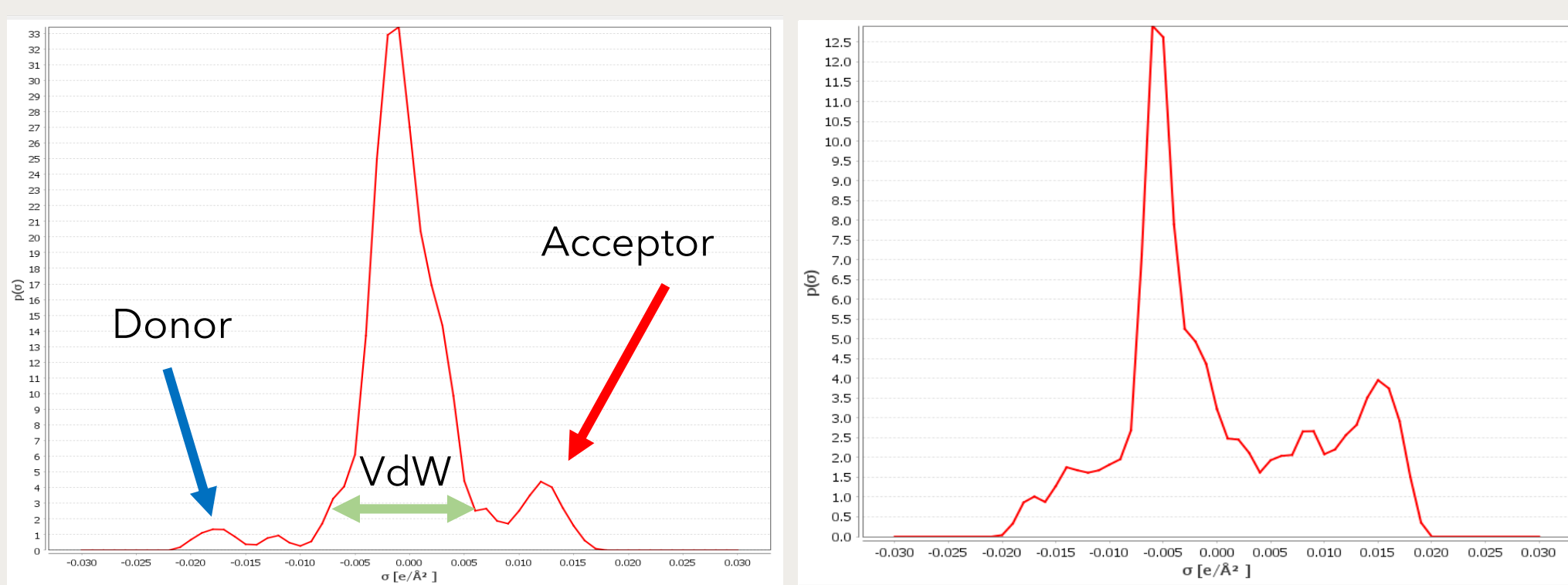
02 Objectives

For a better understanding of their interactions, a thermodynamic property prediction tool has been used: Conductor-like Screening Model for Real Solvents (COSMO-RS).

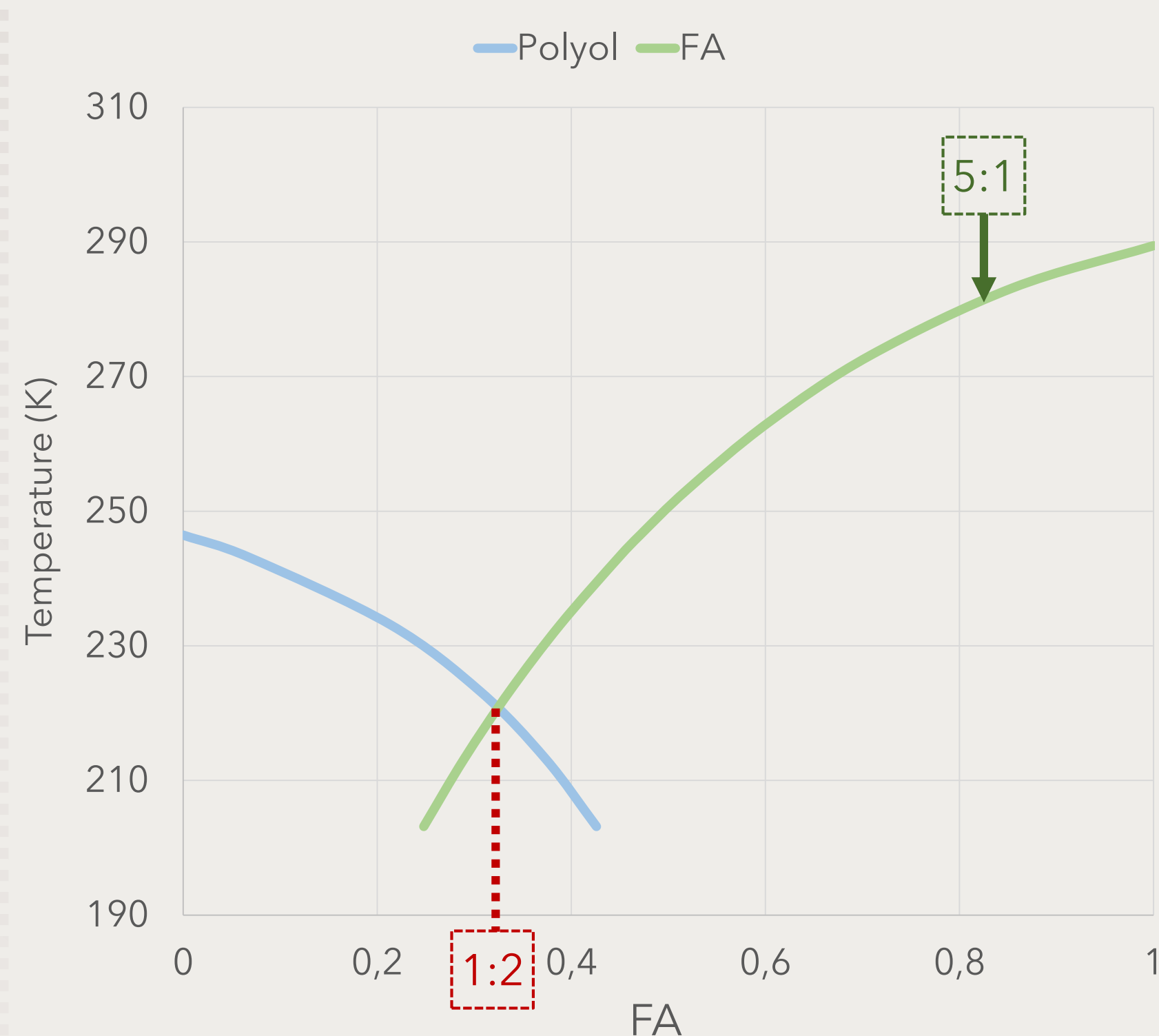
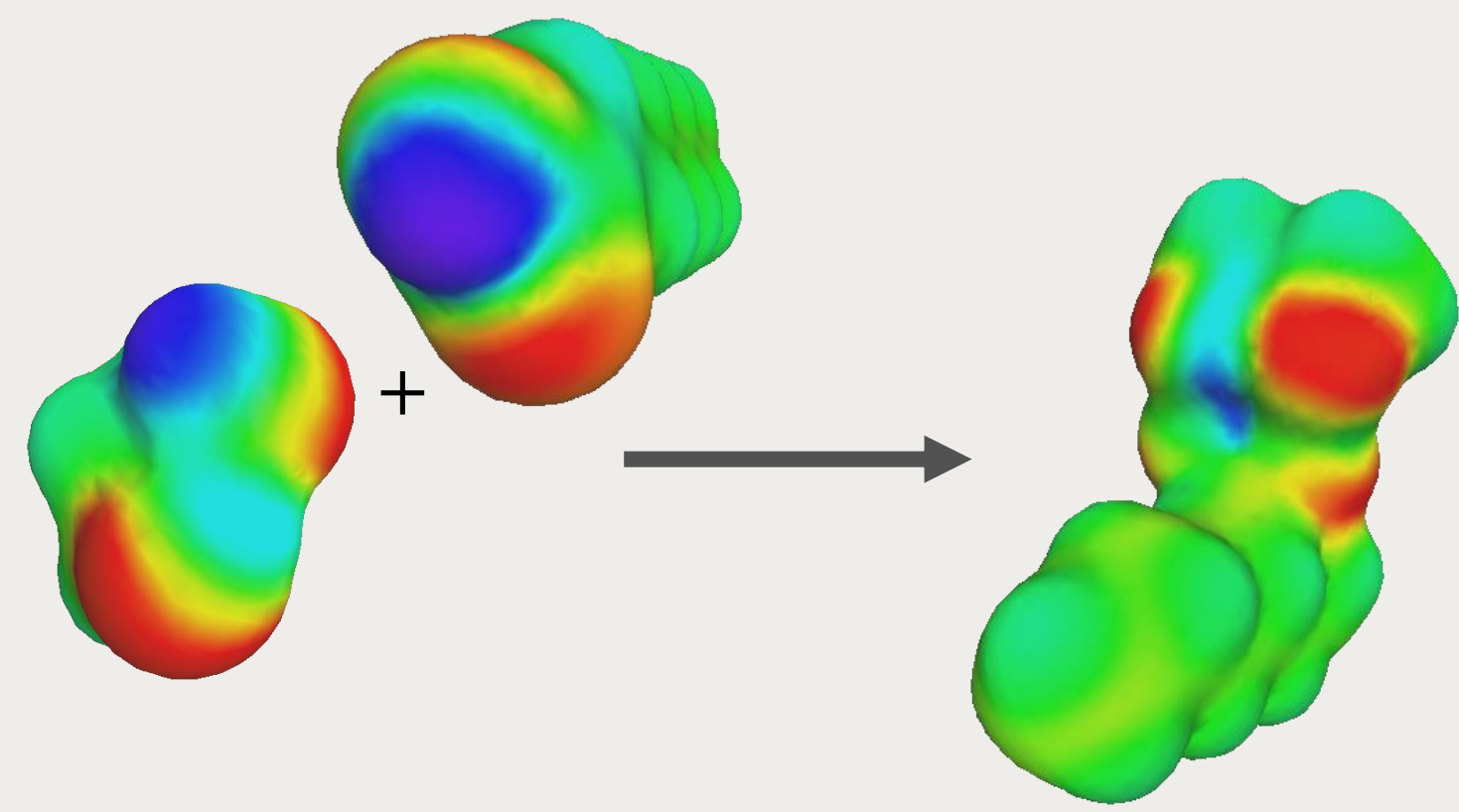
A NaDES made of a fatty acid (FA) and a polyol was tested at 3 different ratios for *Arthrospira platensis* (Spirulina) extraction in order to highlight the influence or not of NaDES composition on the extraction performances.

04 COSMO-RS

A pre-selection step can be performed using σ profiles of a selection of component to estimate molecules associations as one NaDES. Taken in mirror image, these profiles can tell us which components could possibly associate according to their H-bond donor and acceptor groups.

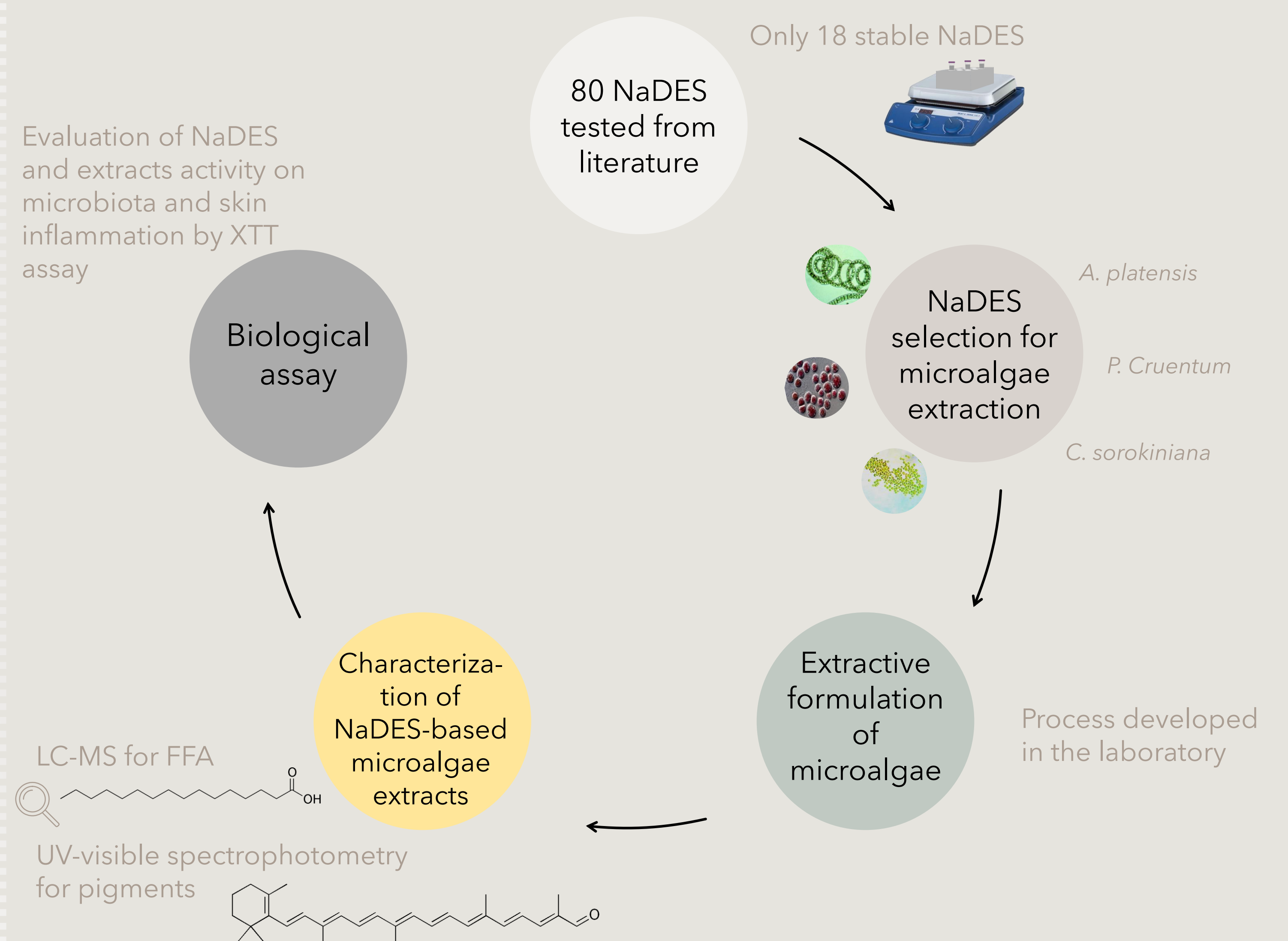


The σ surface of the two pre-selected component i.e., a FA and a polyol, can be generated; as well as the σ surface of these two molecules interacting together according to modeling and conformers determination.



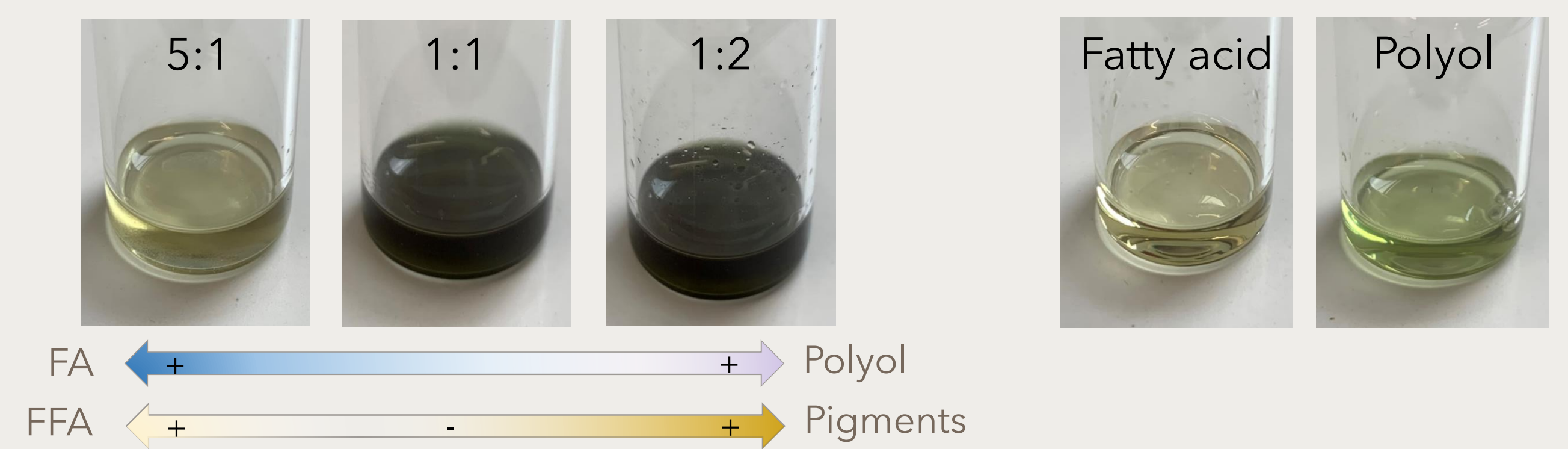
The binary phase diagram enables estimation of the solvent condition at the eutectic point. For the FA:polyol NaDES, **theoretical eutectic point (TEP)** is determined at a molar ratio of 1:2. Experimentally, eutectic point (EEP) was considered at a molar ratio of 5:1. To determine the impact of the eutectic ratio, experimental tests were performed.

03 Pre-established work

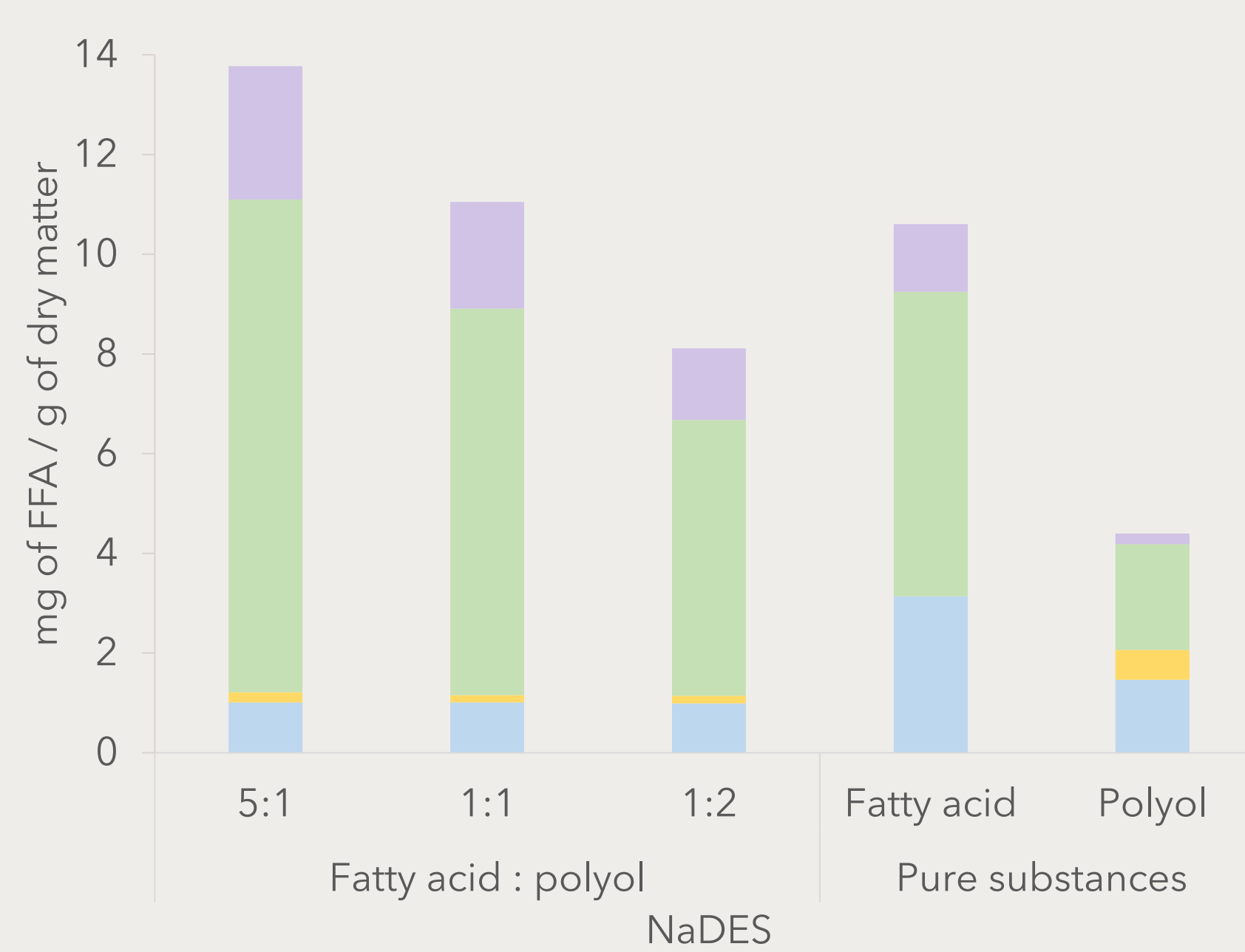


05 Results

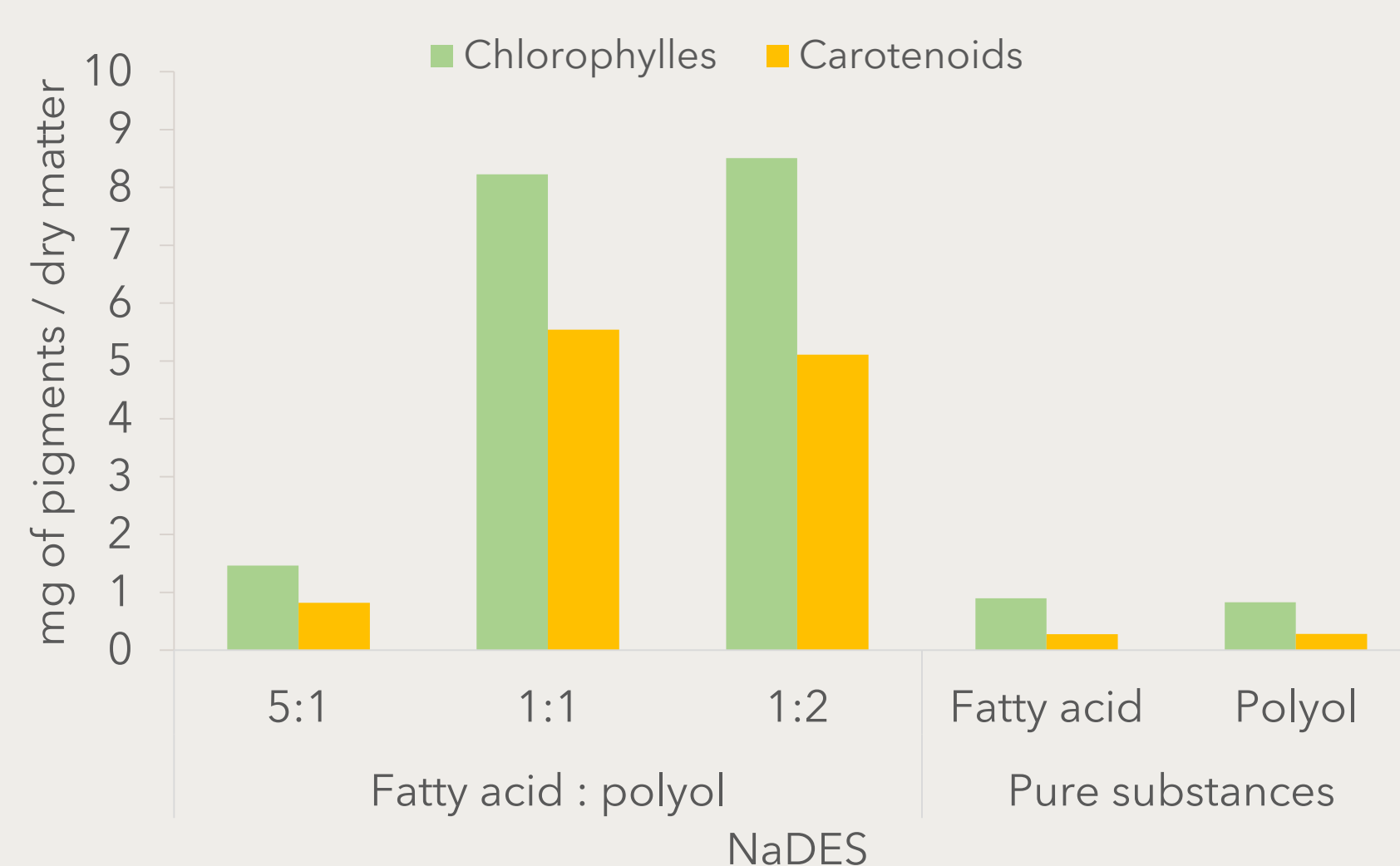
3 molecular ratio of the NaDES FA:polyol have been tested for Spirulina extraction as well as pure compounds to evaluate the efficacy of NaDES.



■ Palmitic acid (16) ■ Linolenic acid (18:3) ■ Linoleic acid (18:2) ■ Oleic acid (18:1)



The extracts performed at the TEP conditions (1:2) show no improvement in terms of FFA extraction. On the other hand, as the FA content in the NaDES increases, more FFA are extracted. The FFA composition of pure bodies shows complementary profiles.



At the conditions of the TEP (1:2) the pigment ratios are significantly higher than the EEP ratio (5:1). Taken alone the components have a very low extraction capacity.

06 Conclusion & Perspectives

The results obtained for the FFA and pigments show the interest of combining the two components

- Taken separately, the FA and the polyol have complementary profile for FFA extraction while for pigments they have a low extraction capacity
- According to the needed properties, both NaDES at theoretical and experimental eutectic point can be valorized.

In the future:

- Selection of NaDES with COSMO-RS according to the solubilization parameters with the metabolites of interest
- Use of COSMO-RS for ternary NaDES and biphasic NaDES simulation
- Dynamic modeling (work in collaboration with InSiliBio)