

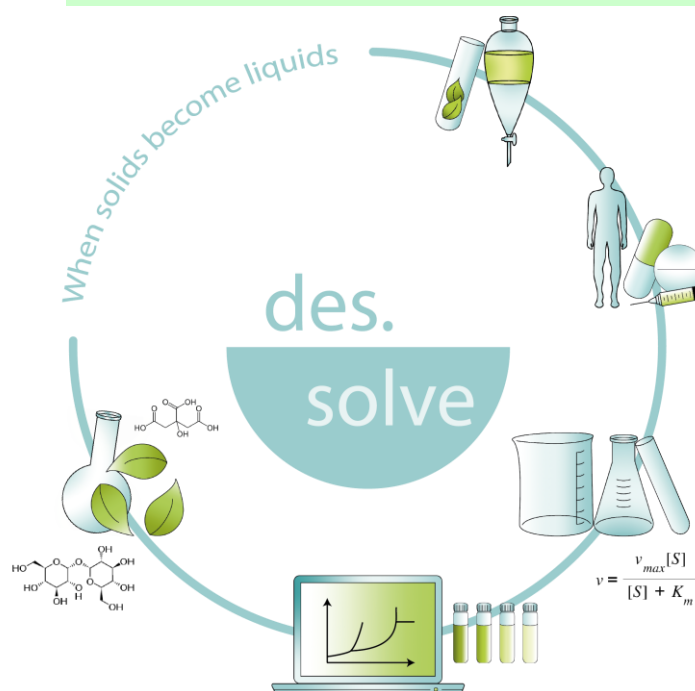
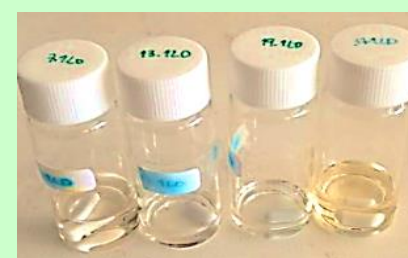


## When solids become liquids: natural deep eutectic solvents for chemical process engineering

Sugars, aminoacids or organic acids are typically solid at room temperature (RT). Nonetheless, when combined at a particular molar fraction, they present a high melting point depression, becoming liquids at RT. These are called Natural Deep Eutectic Solvents – NADES. NADES are envisaged to play a major role on different chemical engineering processes in the future, playing a significant role towards the development of greener and sustainable processes. NADES applications go beyond chemical or materials engineering and cover a wide range of fields such as biocatalysis, extraction, electrochemistry, carbon dioxide capture or biomedicine. The knowledge that will be created with Des.solve project is expected, not only to have a major impact in the scientific community, but also in society, economy and industry.

Des.solve encompasses four major themes of research:

- 1 – Development of NADES and Therapeutic Deep Eutectic Solvents (THEDES)
- 2 – Characterization and computer simulation of NADES/THEDES properties
- 3 – Phase behaviour of binary/ternary systems NADES/THEDES + CO<sub>2</sub> and thermodynamic modelling
- 4 – Application development



### Participation in conferences

- 2nd Chem2Nature Workshop, Porto, Portugal
- TERMSTEM, Porto, Portugal
- ECO-BIO 2018, Dublin, Ireland
- 8th LAQV/UCBIO Conference Cycle, Portugal
- VI National Meeting of Chemical Engineering students, Portugal
- Multidisciplinary Seminar Series, Universitat Rovira I Virgili, Tarragona, Spain
- 6PYChem, Portuguese Young Chemists Meeting, Setúbal, Portugal
- 3rd Green & Sustainable Chemistry, Berlin, Germany
- FLUCOMP, Madrid, Spain

### Publications

- Alexandre Paiva, Ana A. Matias, Ana Rita C. Duarte, How do we drive deep eutectic systems towards an industrial reality?, Current Opinion in Green and Sustainable Chemistry, Vol 11, 81-85, 2018

### Developed work

- Study of the bioactive properties of limonene-based THEDES - anticancer activity, antiproliferative activity, and effect on cell cycle, apoptosis and oxidative stress – showing promising results as a delivery system
- Study of the bioactive properties of menthol-based THEDES - for topical application purposes, combined with fatty acids (antimicrobial activity) - showing good capacity of promoting keratinocytes migration and wound closure
- Study of solid waste streams resulting from fish and shellfish processing industries: canned sardine heads and offal, using betaine-based DES and betaine-based DES aqueous solutions for the recovery of bioactive proteins and peptides
- Study of solid waste streams resulting from fish and shellfish processing industries: brown crab shells, using terpene-based NADES, with hydrophobic character, for the extraction of astaxanthin
- Evaluation of DES' physicochemical properties and study of extraction conditions - DES showed to be promising alternative solvents to isolate bioactive ingredients from fish and shellfish residues
- Evaluation of DES and NADES in biocatalytic processes, in integrated extraction methodology (combination with biopolymers and supercritical CO<sub>2</sub>) and in encapsulation/immobilization processes (performance as functional materials)
- Characterization of THEDES for the treatment of tuberculosis with ethambutol and arginine

### Do you know...

Honey is a Natural Deep Eutectic Solvent?