

# Non-Conventional Yeasts for the Production of Bioproducts

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## Who are we?

Action Chair: **Elia Tomás Pejó**, Action Vice-Chair: **José Luis Martínez**

Non-conventional yeasts are attracting more and more attention owing to their potential to metabolize complex carbon sources, their alternative metabolic routes and their ability to cope with wide range of process conditions. In this context, this Action calls for a strong investment in capacity building through molecular biology, genetic and physiology studies of the non-conventional yeast-derived bioproducts synthesis, which at the moment is relatively scarce. Improving the knowledge on how non-conventional yeasts strains metabolize unusual substrates (carboxylic acids and biomass-derived sugars) or accumulate unusual products (food additives, enzymes, lipids), are fundamental issues to boost the transition to a more sustainable industry based on renewable raw materials.

This Action brings together an innovative group of researchers with the combination of skills and experience to unravel how non-conventional yeast can be successfully implemented in a biotechnology industry. Besides, the Action gathers European top scientists in the field and thus become an important pillar worldwide.

So far, 34 countries are involved in our Action, some of them belong to non-cost countries acting as MC observers (Brazil, Ukraine and Tunisia). Thus, a very strong international network has been created which increases continuously.

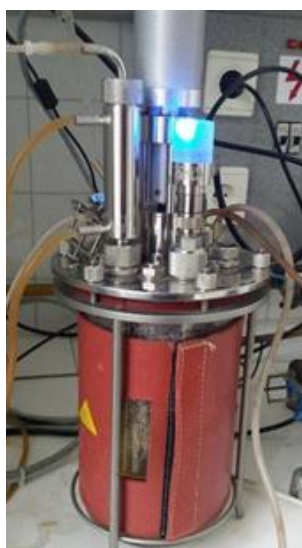
*“This Action brings together an innovative group of researchers with the combination of skills and experience to unravel how non-conventional yeast can be successfully implemented in a biotechnology industry.”*



## Introduction of the working groups



Twin-screw extruder at CIEMAT for biomass pretreatment



Bench-top bioreactor at BUTE for yeast fermentation

### WG1: Production of sugars as platform molecules

*Leader: Ulla Moilanen, Vice-Leader: Yoram Gerchman*

*Number of participants: 40*

The production of sugars as platform molecules is one of the most promising biotechnological routes for the valorisation of organic wastes or lignocellulosic substrates. The main objective of WG1 is to maximize sugar production with the minimum requirements of enzyme loading for their further conversion into bioproducts.

### WG2: Production of carboxylic acids as platform molecules

*Leader: Volkmar Passoth, Vice-Leader: Merle de Kreuk*

*Number of participants: 26*

Carboxylic acids or volatile fatty acids (VFAs) are inexpensive and renewable carbon sources that can be generated from anaerobic digestion of food wastes, agricultural residues and other lignocellulosic feedstocks. The main objective of WG2 is to study the production of VFAs from low-cost biodegradable substrates to be used as fermentation medium by optimizing anaerobic digestion conditions.

### WG3: Non-conventional yeasts capabilities and molecular biology (systems/synthetic biology)

*Leader: Rodrigo Ledesma-Amaro, Vice-Leader: Petri-Jaan Lahtvee*

*Number of participants: 71*

Non-conventional yeasts are capable of metabolizing complex carbon sources and to cope with a wide range of process conditions, using in many cases alternative metabolic routes. Yet, the mechanisms responsible for such traits are mainly unknown or under study. WG3 aims at exploring the possibilities for applying molecular biology and genomics tools for improvement and development of new non-conventional yeasts strains.

### WG4: Bioproducts generation from the sugars platform by non-conventional yeasts

*Leader: Lisbeth Olsson, Vice-Leader: Cecilia Geijer*

*Number of participants: 98*

Due to the capability of non-conventional yeasts to use a wide variety of carbohydrates, a vast range of bioproducts is expected to be produced by them from different lignocellulosic substrates. WG4 targets at exploring different alternatives to produce bioproducts by naturally occurring and recombinant strains of non-conventional yeasts from the sugars released from low-cost raw materials (e.g. agri-food residues, lignocellulose).

*“We think that through this COST action we can go in depth discussion of scientific matters, and to form new projects and concepts.”*

*Charilaos Xiros, PhD - RISE  
Processum AB, Sweden*

*“Therefore I would be interested in this CA and want to contribute and interact with people keen to develop new line of research.”*

*Mustafa Turker, PhD - Pak  
Gıda Üretim Pazarlama A.Ş.  
Turkey*

## Industrial collaborations

*“The main reason I wanted AAK to join was to tie new connections within the community, update us on the state of the art, and find new opportunities for collaboration projects.”*

*Kim Olofsson, Ph.D – AKK  
AB, Sweden*

## WG5: Bioproducts generation from the carboxylate platform by non-conventional yeasts

**Leader: Pierre Fontanille, Vice-Leader: Gwendoline Christophe**

**Number of participants: 34**

The capacity of several non-conventional yeasts to assimilate a broad range of substrates makes these microorganisms an exceptional choice for the conversion of VFAs into a vast number of bioproducts. The main objective of WG5 is to analyse the production of different bioproducts from the carboxylic platform by means of non-conventional yeasts in terms of yields, productivities, profitability and environmental impact.

## WG6: Dissemination and Training

**Leader: Magdalena Calusinska, Vice-Leader: Antonio D. Moreno**

**Number of participants: 23**

Yeast4Bio action aims at disseminating the scientific results by standard means such as publication of articles in peer-reviewed journals, review articles and books, presentations at scientific conferences and annual workshops. WG6 is devoted to disseminating the scientific activities; to deliver the tools and guidelines to stakeholders and to ensure visibility of the action at international level.

## Benefits to our industrial partners

The focus of our Yeast4Bio COST action is highly significant to the industry in many aspects, as non-conventional yeasts have great potential to generate industrially relevant compounds from sustainable resources and biowaste as well as to improve existing yeasts based procedures, making these more cost effective and in an environmentally friendly manner. Yeast4Bio action provides many benefits to our industrial partners such as:

- Find collaborative research partners to solve specific industrial problems
- Find highly motivated candidates with great expertise to work with within a short-term scientific mission
- Participate in Training Schools held by eminent experts of different relevant fields
- Participate in round table discussions and follow innovative state-of-the-art research results
- Find excellent partner institutes and create consortiums to successfully apply for research and development funds

We believe that in collaboration with our industrial partners we can considerably contribute to the development of a greener, sustainable, bio-based economy. We are very happy that our action is considered as a great possibility by many industrial organizations.

## Career development, individual mobility

*“Short Term Scientific Missions (STSMs) are institutional visits aimed at supporting individual mobility, fostering collaboration between individuals.”*



Brewer's spent grain – a promising raw material for fermentations by non-conventional yeasts

(from <https://www.thestar.com/>)

*“ITC Grants supports Early Career Investigators (ECI) and PhD Students from participating ITCs to attend international conferences, meetings and other scientific activities.”*

## Short Term Scientific Missions

STSM-Coordinator: **Susana Marques**

Regarding STSMs in COST Action Yeast4Bio, this activity has also been disturbed by COVID 19 outbreak, as expected. Contrarily to other activities, Yeast4Bio has not suspended STSMs and calls have been launched throughout 2020-2021, giving this opportunity to researchers. Following the approval of 4 STSMs applications in the 1<sup>st</sup> Grant Period, 10 additional STSMs have been submitted in the 2<sup>nd</sup> Grant Period. However, of these 14 applications approved for STSMs, only three visits have already been completed (with one visit cancelled in 2020, and one visit in course and nine to start till October 2021).

## Experiences of completed STSMs

by **Anita Jurić**

Dr. Anita Jurić successfully accomplished a STSM entitled “Conducting fermentation of glucose and other hexoses using yeast” at Bar-Ilan University, Ramat-Gan (Israel) under the supervision of prof. Aharon Gedanken.

Prof. Aharon, in his previous research, has already used soft sonication for conducting fermentation of glucose (accelerated fermentation by a factor of 11 as compared with a stand still reaction) but with conventional yeast *Saccharomyces cerevisiae*. In this research, soft sonication was used for conducting fermentation of brewers spent grain (BSG) in both the non-conventional yeast *Candida lipolytica* and conventional yeast *Saccharomyces cerevisiae*. *S. cerevisiae* was procured from a supermarket in Israel and yeast *C. lipolytica* cultivated at University of Zagreb, Croatia. BSG is generated from a process using 100% malted barley BSG and was obtained from Hercegovacka brewery located in Bosnia and Herzegovina. The kinetics of the fermentation process was monitored by 13C nuclear magnetic resonance (NMR), as well as a weight decrease of the fermentation broth because of CO<sub>2</sub> release. Many thanks to prof. Gedanken and his laboratory for the nice cooperation and successful work.

## Inclusiveness Target Countries Conference Grants

ITC Conference Manager: **Hana Sychrova**

Inclusiveness Target Countries (ITC) Conference Grants support Early Career Investigators (ECI) and PhD Students from participating ITCs to attend international conferences, meetings and other scientific activities related to the main topic of the Action.

Although being an excellent funding opportunity and a key tool in this COST Action, this activity is on hold due to the current need of virtual participation at international events. These ITC grants will play again an important role in future granting periods.

## Dissemination, achievements

*“Working Group meetings and Management Committee meetings are regularly organised within our Action.”*

## Events organized

Working Group meetings and Management Committee meetings are regularly organised within our Action to share knowledge and experiences, create research networks and collaborations and manage Action activities. Our accomplished events are:

Kick-off and 1st MC meetings were held in Brussels at the COST Association facilities on the 7<sup>th</sup> of November, 2019.

The 1<sup>st</sup> WG and 2<sup>nd</sup> MC meetings were organized by Csaba Fehér and hosted by the Budapest University of Technology and Economics in Hungary on 9<sup>th</sup> and 10<sup>th</sup> of March, 2020.

The 2<sup>nd</sup> WG meeting was organized online by Igor Stuparevic from Zagreb University on the 10<sup>th</sup>-11<sup>th</sup> of November, 2020.



*“One of the Action’s key outputs is the publication of scientific results and outcomes.”*

## Publications

One of the Action’s key outputs is the publication of scientific results and outcomes. So far, the Yeast4Bio participants have already published two original research articles and one bibliographic review related with the Action:

Bedó, S.; Fehér, A.; Khunnonkwao, P.; Jantama, K.; Fehér, C. Optimised bioconversion of xylose derived from pre-treated crop residues into xylitol by using *Candida boidinii*. *Agronomy* 2021, 11(1), 79.

Moreno, A.D.; Tomás-Pejó, E.; Olsson, L.; Geijer, C. *Candida intermedia* CBS 141442: A novel glucose/xylose co-fermenting isolate for lignocellulosic bioethanol production. *Energies* 2020, 13(20), 5363.

Tomás-Pejó, E.; Morales-Palomo, S.; González-Fernández, C. Microbial lipids from organic wastes: Outlook and challenges. *Bioresource Technology* 2021, 323, 124612.



*Rhodotorula toruloides*  
ATCC 204091

## Future activities, communication



In addition to the already published papers, a Thematic Issue (TI) based on the Yeast4Bio COST Action is under preparation in collaboration with FEMS Yeast Research journal. The TI will include up to 15 bibliographic review articles and will establish the state of play for the use of non-conventional yeasts for biotechnology and set out the potential in the frame of the Work Plan of the COST Action. The launch date for this TI is expected by November 2021.

## Database

The Yeast4Bio COST Action is developing an internal Database for listing the different yeast strains from the particular culture collection of each participant. Such Database will facilitate sharing any relevant information involving listed microorganisms (e.g. genetic modifications, carbon sources, main product). The Yeast4Bio Database contains 8 different non-conventional yeast strains so far.

## Planned events

The 2<sup>nd</sup> MC meeting and the 3<sup>rd</sup> WG meeting are planned for the 28<sup>th</sup> and 29<sup>th</sup> of September, 2021, in La Coruña (Spain).

Training School on Applied fermentation technology for production of high value chemicals by non-conventional yeasts from sugars is planned for 13<sup>th</sup>-17<sup>th</sup> September, 2021. It will be organized by Dr. José Luis Martínez at DTU (Denmark).

## How to find us

Science Communication Manager: **Csaba Fehér**

For more information about the Yeast4Bio COST Action, please visit our website and follow our social media profiles.

Webpage: <https://yeast4bio.eu/>

Twitter: <https://twitter.com/yeast4bio>

LinkedIn: <https://www.linkedin.com/company/yeast4bio-project>

### Grant Holder Institution

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Administrative officer: Nathalie Warengien

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### COST description

COST is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.  
<https://www.cost.eu/>

