From the tropics to the lab: New yeasts could transform industry

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The illustration shows the different layers of the bioprospecting project—the journey of the yeast from its place of origin to a purified yeast isolate. Material was collected from across Nigeria, yeast was cultivated on plates, then streaked for purification, isolated, collected, and, in some cases, identified to species level through sequencing. Credit: Karl Persson

Yeast cells can be used to convert agricultural and forestry residues, as well as industrial byproducts, into valuable bioproducts. New and

unexplored yeast strains may have properties that can enhance the commercial competitiveness of this sustainable production. In a study recently published in *Applied and Environmental Microbiology*, researchers collected and examined the biotechnological potential of 2,000 West African yeast strains.

The study—the first of its kind—is a collaboration between the University of Nigeria, Chalmers University of Technology, and the University of Gothenburg. It is based on a nationwide collection of samples from fruit, bark, soil, and waterways in Nigeria. This approach, known as bioprospecting, involves exploring various plants or microorganisms in nature to identify properties that can be utilized for different industrial or societal applications.

In this study, researchers searched for new yeast species with the potential use in industrial production of biochemicals, pharmaceuticals, and food ingredients.

"Our partners collected the samples in the tropics in Nigeria. This region has high biodiversity in plants and animals, and we assumed there would also be a high diversity of yeast species. In addition, this region is particularly exciting since very few yeast isolates from West Africa have been documented," says Karl Persson, postdoctoral researcher in industrial biotechnology at the Department of Life Sciences and first author of the study.

Students collected samples from across the country

Persson began working on this study as a side project during his Ph.D. education at the University of Gothenburg. Here he worked in Jonas Warringer's research group, which focuses on yeast evolutionary biology.

"We were intrigued by the idea that unknown yeasts from unexplored

tropical regions could have biotechnological and food technology potential. We launched a collaborative project with Dr. Onyetugo Amadi at the University of Nigeria, who had previously been an exchange student at the University of Gothenburg," says Jonas Warringer.

Six students from Onyetugo Amadi's research group collected samples from across Nigeria, isolating a total of 6,000 yeast strains. The unique yeast collection was then brought to the University of Gothenburg by Nigerian students Vanessa Onyema and Ijeoma Princess Nwafor, who explored the yeast strains' potential under the supervision of Persson and Warringer.

Focus on lacto-degrading yeast strains

Approximately 2,000 yeast strains were selected for analysis, where they were screened for growth in 70 different cultivation conditions. The researchers examined, among other things, how the strains grew on different carbon and nitrogen sources.

One major finding was that many of the strains could grow on lactose. Lactose is the main carbon source in cheese whey, a byproduct of the dairy industry that is produced in large volumes and often discarded. In a sustainable production system, whey could instead be utilized by yeast cells to create valuable bioproducts.

The lactose-degrading strains were further analyzed by Persson, during his postdoctoral fellowship in Cecilia Geijer's research group at Chalmers, in the Division of Industrial Biotechnology.

"At Chalmers, we identified 203 strains capable of growing on lactose, belonging to 30 different yeast species, some of which may be entirely new species. Several of them also demonstrated the ability to convert lactose into microbial oils, suggesting they could be strong candidates for

biotechnological applications," says Persson.

Producing oils using yeast could be a more environmentally friendly alternative to fish oil, palm oil, or petroleum-based products.

"In our lab, we also have the exciting capability to engineer yeast strains to produce higher amounts of specific fatty acids that are in high demand in industry and society," says Geijer.

'Important and rewarding'

According to Persson, the collaborative project underscores the power of bioprospecting. In a parallel project, he and Geijer collected honey samples from across Sweden to study yeast biodiversity and investigate unknown yeast species' industrial potential.

"At the start, you don't know what you're looking for—or what you might find. The discoveries emerge over time, which has been the case in both projects. Additionally, yeast isolate collections can be used for many different purposes, depending on what is found. That's something I find fascinating about our research," he says, adding:

"International collaborations like this are both important and rewarding, and we hope these yeast strains will benefit Nigeria in the future."

More information: Karl Persson et al, Lactose-assimilating yeasts with high fatty acid accumulation uncovered by untargeted bioprospecting, *Applied and Environmental Microbiology* (2024). DOI: 10.1128/aem.01615-24

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