Yeast in a shell: Coating individual living yeast cells with silicon dioxide

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(PhysOrg.com) -- Our breakfast egg is a peculiarity of nature: a single cell protected by a thin mineral layer. Apart from a number of tiny radiolaria and diatoms, individual cells normally do not have a hard shell. Korean researchers have now developed a strategy for equipping individual cells of baker's yeast, Saccharomyces cerevisiae, with a synthetic shell made of silicon dioxide. As the team led by Insung S. Choi reports in the journal *Angewandte Chemie*, the lifespan of these coated yeast cells is tripled, whilst their division is suppressed. The shell also protects the cells from unfavorable external conditions.

Whereas other research efforts previously succeeded in coating yeast cells with a phosphate mineral layer, individual cells have not previously been encapsulated in silicon dioxide. Inspired by the natural shell formation of diatoms, the researchers developed a biomimetic process to coat individual cells under mild physiological conditions. The surfaces of diatoms are covered with special long-chain molecules that contain many positively charged groups of atoms and initiate biomineralization.

The researchers imitated this process by equipping the cell membranes of the yeast cells with synthetic polymers, always alternating layers with many positive charges and layers with many negative charges -- a total of 21 layers. When the yeast cells that have been treated in this way are placed in a solution containing negatively charged silicic acid compounds, these dock onto the outermost positively charged layer of the yeast shell. There they mineralize to silicon dioxide and completely encapsulate the yeast cells.

Genetically modified yeasts are used to produce important pharmaceutical agents. In molecular biological research, easily cultivated yeasts are often used for fundamental investigations of cellular processes and for the diagnosis of human diseases. The protection and improved shelf life possible because of the shell could enable new avenues of research. In addition, the shell could act as a scaffold for the introduction of modifications to the chemical and biological properties.

More information: Insung S. Choi, Biomimetic Encapsulation of Individual Cells with Silica, Angewandte Chemie *International Edition*, doi: 10.1002/anie.200903010

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