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Glass transition temperature offers insights into the thermodynamics of bacterial growth FREE

Alane Lim

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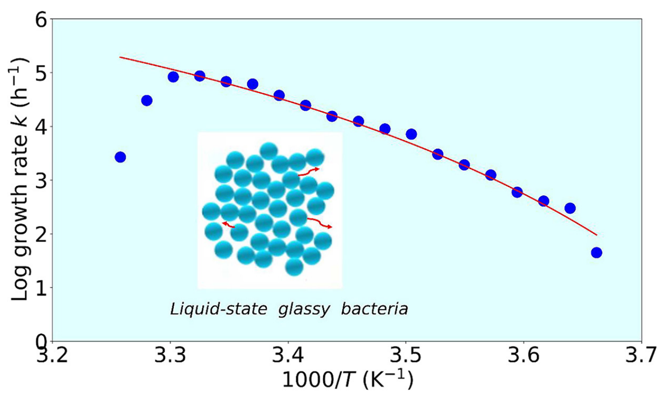
A model typically applied to non-living materials could improve our understanding of organisms.



Many inorganic materials can change from a liquid to a glassy-like or glassy state at the glass transition temperature. While scientists have primarily applied this concept in physical chemistry, recent research has found that the concept may apply to biology as well. Carlito Pinto and Koichi Shimakawa developed a biological model, based on the theory of the glass transition temperature, that may more accurately describe bacterial growth than a widely accepted model in microbiology.

The team proposed an exponential relationship based on activation energy and temperature to describe the growth rate of three types of bacteria. This approach was based on recent findings that suggested bacterial cytoplasm exhibits properties similar to inorganic glass-forming liquids. The authors found their models fit the growth of their specimens well, as exemplified by an R-squared value of 0.95 or higher.

“Our model may have a better physiological basis than the square-root temperature model that is currently widely accepted in the microbiological field,” co-author Koichi Shimakawa said, adding that the scientific foundation for the current model is unclear.

To create their model, the team applied known thermodynamic principles and equations to the observed growth rates of *Bacillus circulans*, *E coli*, and *Aerobacter aerogenes*, deriving needed parameters by fitting the models to their experimental results.

Shimakawa says the study may have important implications for food science and other industries.

“Currently, the food sciences industry uses the square-root temperature model to predict food spoilage,” he said. “Using our model in its place could improve the safety of foods sold for consumption.”

Source: “Glassy dynamic in bacterial growth rate temperature dependence,” by Carlito Pinto and Koichi Shimakawa, *AIP Advances* (2023). The article can be accessed at https://doi.org/10.1063/5.0139055.

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