MedicalXpress

Thermally stable TB vaccine closer to reality thanks to microscopic silica cages

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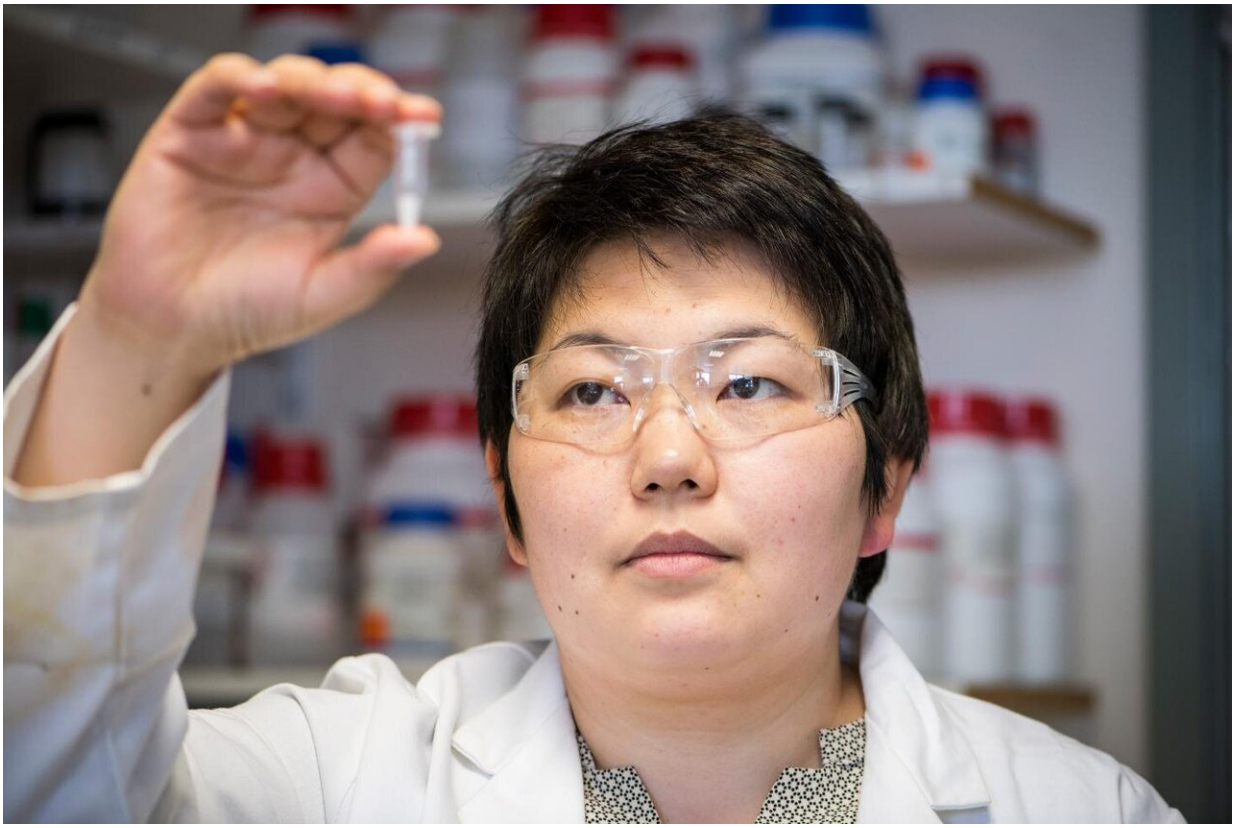

Dr. Asel Sartbaeva with a vial of ensilicated protein. Credit: University of Bath

Scientists working on a new tuberculosis (TB) vaccine have achieved a major step forward by showing that a promising TB antigen and a novel vaccine adjuvant can be protected from heat damage with a technique

developed at the University of Bath.

Their method prevents these crucial vaccine components from spoiling outside of a fridge—meaning a thermally stable vaccine that can be reliably delivered to remote areas around the world is more likely.

There is an urgent need not only for a new TB vaccine, but also for methods to keep vaccines stable outside of the refrigeration 'cold chain' - as up to 50% of vaccine doses are discarded before use due to exposure to suboptimal temperatures. Thermostable vaccines have therefore been named a priority research area in the World Health

Organisation's Global Vaccine Action Plan 2011-2020.

Ensilication, a method developed at the University of Bath, "shrink-wraps" vaccine proteins in position using layers of silica that build up into a cage around the molecules—so they don't unravel when exposed to temperatures that would usually break them down. The proteins are held in place until ready to be removed from the silica cage and delivered.

The research team from the Departments of Biology & Biochemistry and Chemistry first demonstrated that the TB antigen ag85b and a vaccine fused with the adjuvant protein Sbi are sensitive to breaking down outside of refrigerated temperatures. They then showed that these vaccine components were protected from heat damage when ensilicated and kept on a shelf at room temperature for long periods of time without loss of structure and function.

This is first time that ensilication has been used to improve the thermal stability of proteins in a vaccine setting, after proof-of-principle work using model proteins.

The results are a big step forward not only in developing a thermally-

stable TB vaccines, but in showing that ensilication could be used for many different kinds of vaccines.

The study is published in *Scientific Reports*

Lead author Professor Jean van den Elsen, said: "A new TB vaccine is really urgently needed to supplement or replace the existing BCG vaccine and reduce the number of TB cases and deaths—particularly as drug-resistant TB infections remain high."

First author Ayla Wahid, added: "To make the vaccine as effective as possible it needs to be thermally-stable, or in other words not spoil outside of a fridge, which is why we're really encouraged by these results. Cold-chain storage leads to a lot of wastage and expense which could be avoided by ensilication."

Dr. Asel Sartbaeva, who invented ensilication, added: "Our results reveal the potential of ensilication in storing and transporting life-saving vaccines at ambient temperatures globally—in particular to remote areas of developing countries where disease rates are often highest.

"With up to 50% of vaccines being thrown away, and refrigeration raising vaccine costs by up to 80%, this is a major global health challenge that we need to overcome. By demonstrating for the first time that ensilication works to protect vaccine-relevant proteins from breaking down outside a fridge we're a big step closer to achieving this goal."

More information: A. A. Wahid et al, Ensilication Improves the Thermal Stability of the Tuberculosis Antigen Ag85b and an Sbi-Ag85b Vaccine Conjugate, *Scientific Reports* (2019). DOI: 10.1038/s41598-019-47657-9

Provided by University of Bath