The Use of BioCargos on Biospecimen Storage at Room Temperature

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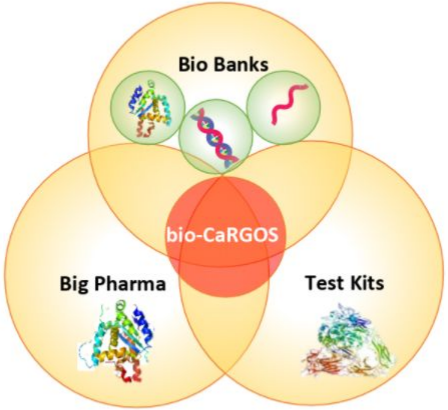
Purpose

- The preservation of biospecimens at room temperature (25 ℃) over 21 days to demonstrate stability
- The experimental portion will use Bovine serum albumin (BSA) proteins as the biospecimens
- The BSA will be preserved by encapsulation in BioCargos (capture and release gels for biospecimen storage)

Preservation of biospecimens and proteins at room temperature.

Why is this important?

- Real life applications include biobanks (cancer research), vaccines, test kits for COVID-19
- The biological samples are RNA, DNA, and protein based
- Efficient preservation methods for these samples are necessary during transport and in laboratory settings

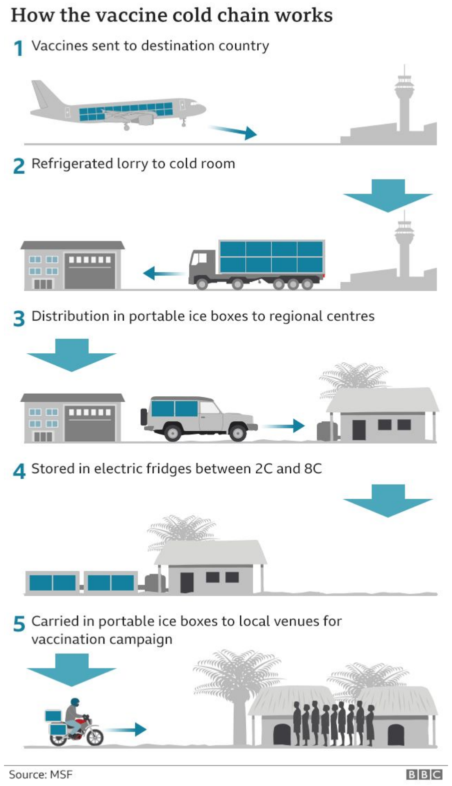


Applications to optimized storage of cancer biobanks, vaccines, and test kits.

Past Methods

- Biospecimens are typically stored in cryopreservation
- Stored in refrigeration for short-term storage (-20℃) or in a freezer for long-term storage (-80 ℃)
- Cryopreservation poses many challenges because it's difficult to find the correct cold chain balance, is high energy-consuming, and expensive

Current preservation method is cryopreservation, which can be problematic.



Silica Sol-Gel Method

- For this project, stability is being achieved at room temperature, rather than with a cold chain
- At room temperature, proteins tend to denature
- Tetramethyl orthosilicate sol-gels show to be ideal for preservation due to durability, chemical stability, and cost
- Challenges include maintaining the proteins' pH and getting rid of the methanol from the TMOS sol-gels

This project will preserve the BSA at room temperature through encapsulation in TMOS sol-gels (BioCargos).

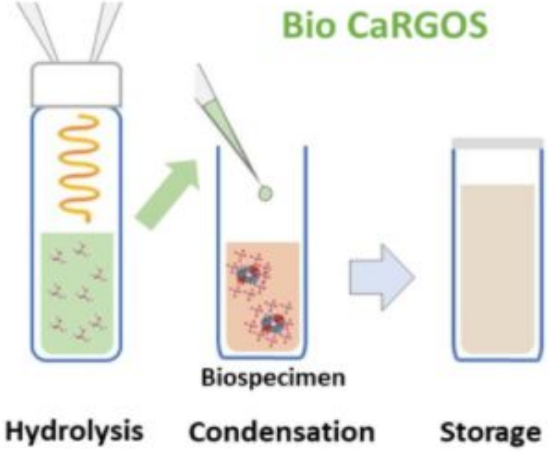
Research Hypothesis & Objective

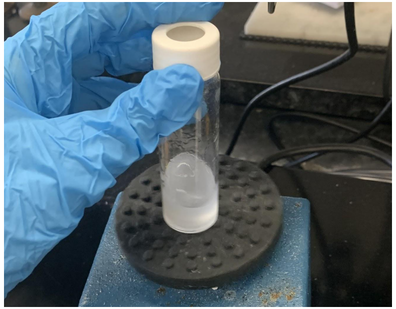
- If the BSA proteins are encapsulated in the BioCargos, then the rate of degradation for the BSA will be slower over 21 days, ensuring stability, compared to that of the control BSA.
- The stability of the BSA proteins will be indicated by the present concentration of the BSA in the samples tested at 7, 14, and 21 days.

Stability is indicated by the concentration of living BSA at days 7, 14, and 21. Data for the control BSA and BSA with BioCargos will be compared.

Methodology

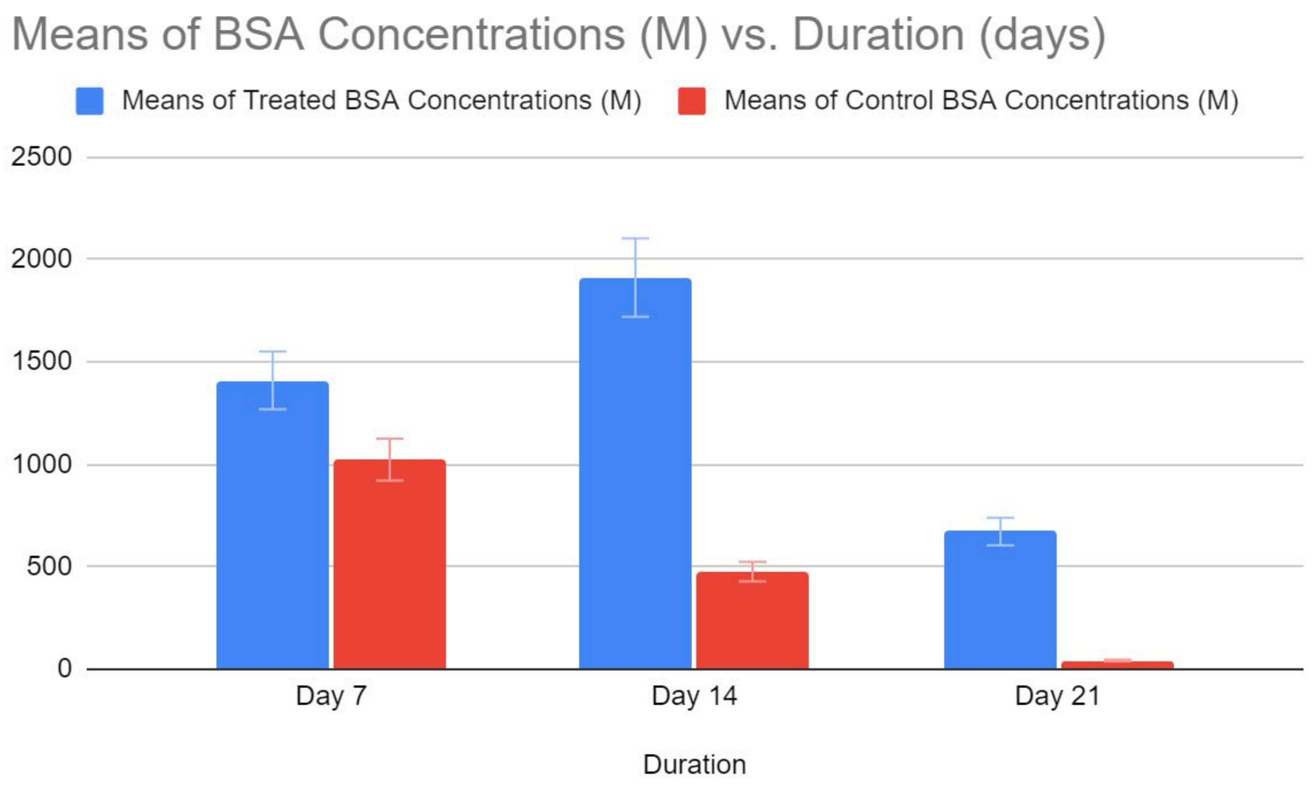
- First, prepare the TMOS sol-gels with a concentration of TMOS and distilled water
- Then, microwave the solution to release methanol gas
- Next, encapsulate BSA and buffer solution in sol-gel solution and store at 25 ℃





Key Advantages:
1 step process
Total Time: <5 mins
Use of one chemical
Room temperature storage
Self-sterile

Data and Results



Conclusion and Summary

- The results prove the research hypothesis and show proper stability of the BSA at room temperature with the use of the BioCargos
- The encapsulated BSA were likely able to stay more stable because of its confinement in the silica matrices and its thermal conductivity properties, which prevented the proteins from unfolding
- This simple, reliable preservation method can be applied to real life in biobanks (cancer research), vaccines, and COVID-19 test kits

Results show that the experiment was a success, and worked due to the silica matrices properties.

Future Research

- One recommendation for future research is silica separation from the BSA, which is presently being achieved
- This is to be achieved using specifically sized filters that can potentially separate the silica from the BSA
- Silica separation is important for the BSA to be obtained from encapsulation and put into use

Silica separation is to be achieved for future research and expansion on this project.

Acknowledgements

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Thank you for listening!

Questions?