## Surviving in Salty Environments: Halophilic Archaea and Biotechnological Applications

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## What are halophilic Archaea?

Halophilic archaea are microbes that thrive in environments with salt concentrations at 3-4 M, or about six times saltier than the ocean.<sup>[1]</sup>



Halophilic Archaea have evolved multiple traits to survive in saline environments:

 Import of potassium ions to combat the negative water potential and avoid water loss.<sup>[2]</sup>

How do halophilic Archaea

survive in extremely salty

environments?

 Proteins have more acidic amino acids on the surface to bind water molecules.<sup>[2]</sup>

Haloquadratum walsbyi

Halobacterium cells

Colony of Haloarchaea

**The habitat** of halophilic Archaea is often saline water bodies, such as salty lakes, salterns, underground brines, the Dead Sea, and other areas with salt sediments<sup>[2]</sup> as shown in the map.





• Some have a protein called **Bacteriorhodopsin**, which captures **light energy** and generates a proton motive force.<sup>[2]</sup>

## The biotechnological applications of halophilic Archaea



**Applications of living cultures** 



**Applications of cell products** 

- **Bioremediation** of nitrates or nitrites from saline wastewater.
- Faster **fermentation** of food in saline solutions.
- Astrobiology applications: The capability of halophilic Archaea to endure long periods in dry, salty environments, similar to Martian conditions, hints at the possibility of life on Mars, especially given their early emergence and resilience on Earth.
- Enzymes such as **proteases** or **lipases** used in saline reactions, such as detergents.
- Light-capturing Bacteriorhodopsin used for dry, artificial retinas.
- Production of biodegradable polymers
- Producing Haloarchaeal gas vesicles for use in drug delivery.

## References

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[2] Fendrihan, S. et al. Rev. Environ. Sci. Biotechnol. 5, 203–218 (2006).
[3] Pancsa, R., Kovacs, D. & Tompa, P. Mol. 2019, Vol. 24, Page 479 24, 479 (2019).

