



Scientists Develop New Refrigeration Method

Description

Ionocaloric cooling is a new technology that could change how we cool things. It might replace current methods with an approach that is safer and better for the environment.

Traditional refrigerators use a fluid to move heat away by turning it into gas, then back into liquid. However, some refrigerants harm the environment.

In 2023, researchers from Lawrence Berkeley National Laboratory and the University of California, Berkeley, developed a new method. It uses how energy is stored or released when a material changes phase, such as ice melting into water.

This technique uses ions, which are charged particles, to make ice melt without heating it. When ice melts, it absorbs heat and cools its surroundings. The ionocaloric cycle uses salt to cause this change and cool things down.

According to mechanical engineer Drew Lilley, finding a refrigerant that is efficient, safe, and eco-friendly is an unsolved problem. He believes ionocaloric cooling could meet these goals. A small electric current helps move ions, changing the material's melting point and causing a temperature change.

Experiments with salt and a common solvent showed a temperature drop of 25 °C with less than one volt of charge. This is more effective than other cooling methods.

Countries that signed the Kigali Amendment aim to reduce harmful gases, and ionocaloric cooling could help this goal. Now, researchers are working to make the technology usable in everyday systems. Different salts are being tested to find the best combinations for heat removal. Results of these studies were published in the journal *Science*.



Vocabulary List:

1. **Ionocaloric** /aɪ.əʊ.nə'kæɪ.ərɪk/ (adjective): Relating to cooling produced by ions that change a material's heat storage during a phase change.
2. **Refrigerant** /rɪ'frɪdʒərənt/ (noun): A substance used in cooling systems that absorbs and releases heat as it evaporates and condenses.
3. **Phase** /feɪz/ (noun): A distinct physical state of matter (solid liquid or gas); often used with "phase change" like melting or freezing.
4. **Ions** /'aɪ.ənz/ (noun): Atoms or molecules that carry an electric charge because they have gained or lost electrons.
5. **Solvent** /'sɒlvənt/ (noun): A liquid that dissolves another substance (a solute) to form a solution; in the article the liquid mixed with salt.
6. **Melting point** /'mɛltɪŋ pɔɪnt/ (noun): The temperature at which a solid turns into a liquid.

Comprehension Questions

Multiple Choice

1. What technology could change how we cool things?
Option: Electrocaloric cooling
Option: Ionocaloric cooling
Option: Thermal cooling
Option: Magnetocaloric cooling
2. Which research institutions developed the ionocaloric cooling method?
Option: Harvard University and MIT
Option: Stanford University and UC Santa Barbara
Option: Lawrence Berkeley National Laboratory and the University of California, Berkeley
Option: California Institute of Technology and Stanford University
3. What is used to make ice melt in the ionocaloric cooling technique?
Option: Electricity
Option: Water
Option: Ions
Option: Gas



4. How much did the temperature drop in experiments with salt?

Option: 10 °C

Option: 20 °C

Option: 25 °C

Option: 30 °C

5. What is the main disadvantage of traditional refrigerators?

Option: They are too expensive

Option: They require too much electricity

Option: Some refrigerants harm the environment

Option: They do not cool effectively

6. What is the goal of the Kigali Amendment?

Option: To promote ionocaloric cooling

Option: To reduce harmful gases

Option: To improve energy efficiency

Option: To increase refrigeration capacity

True-False

7. Ionocaloric cooling replaces traditional cooling methods entirely.

8. The ionocaloric cycle causes a material to change its melting point.

9. Drew Lilley believes that finding an eco-friendly refrigerant is a solved problem.

10. Ionocaloric cooling does not require any electric current.

11. The results of the ionocaloric cooling studies were published in the journal Science.

12. Countries that signed the Kigali Amendment aim to increase harmful gas emissions.

Gap-Fill

13. Ionocaloric cooling could replace current methods with an approach that is safer and better for the

_____.



14. Traditional refrigerators turn gas back into _____ to move heat away.
15. This technique uses _____ to make ice melt without heating it.
16. Experiments showed a temperature drop of _____ °C with less than one volt of charge.
17. Researchers are testing different _____ to find the best combinations for heat removal.
18. The ionocaloric cycle helps in the process of _____ and cooling down.

Answer

Multiple Choice: 1. Ionocaloric cooling 2. Lawrence Berkeley National Laboratory and the University of California, Berkeley 3. Ions 4. 25 °C 5. Some refrigerants harm the environment 6. To reduce harmful gases
True-False: 7. False 8. True 9. False 10. False 11. True 12. False
Gap-Fill: 13. environment 14. liquid 15. ions 16. 25 17. salts 18. melting

Vocabulary quizzes

Multiple Choice (Select the Correct answer for each question.)

1. Which term refers to a microorganism that can cause disease in the bloodstream?
Option: Virus
Option: Bacterium
Option: Fungus
Option: Protozoa
2. What biological response is characterized by redness, heat, swelling, and pain?
Option: Infection
Option: Inflammation
Option: Allergy
Option: Necrosis
3. What molecule carries genetic information in living organisms?
Option: RNA



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- Option: Proteins
Option: DNA
Option: Lipids
4. What term describes bacteria that are not affected by antibiotics?
Option: Sensitive
Option: Resistant
Option: Dormant
Option: Virulent
5. What treatment uses chemical substances to kill or slow the growth of cancer cells?
Option: Radiation
Option: Surgery
Option: Chemotherapy
Option: Immunotherapy
6. What is the term for the temperature at which a solid becomes a liquid?
Option: Boiling point
Option: Melting point
Option: Freezing point
Option: Sublimation point
7. Which mineral is essential for muscle and nerve function?
Option: Calcium
Option: Magnesium
Option: Potassium
Option: Iron
8. What type of function refers to mental processes such as thinking and remembering?
Option: Cognitive
Option: Emotional
Option: Physical
Option: Creative
9. Who is a professional that advises on nutrition and diet planning?
Option: Physician
Option: Dietitian
Option: Chef
Option: Nurse
10. What term describes the brain's ability to adapt and change?
Option: Neurotransmission
Option: Neuroplasticity



Option: Neurogenesis

Option: Neuroscience

Gap-Fill (Fill in the blanks with the correct word from the vocabulary list.)

11. The _____ effect relates to the impact of ions on caloric content.
12. The _____ is used in air conditioning and refrigeration systems.
13. Water is commonly known as a universal _____.
14. High levels of _____ can adversely affect health.
15. Some chemicals are known to be _____ and can cause harm.
16. The Mediterranean diet is known for its numerous health _____.
17. Meat, fish, and dairy are rich sources of _____.
18. The _____ of a material affects its buoyancy in water.
19. Exercise can _____ cognitive function and memory.
20. The _____ components of a cell include its membrane and organelles.

Matching Sentences (Match each definition to the correct word from the vocabulary list.)

21. The Mediterranean diet is renowned for its health benefits and balance of nutrients.
22. Maintaining proper nutrition is essential for optimal brain health throughout life.
23. The nervous system transmits signals throughout the body via network of nerves.
24. Regular exercise helps to strengthen and build muscles, enhancing physical capacity.
25. Personal stories can serve as powerful sources of inspiration for others.
26. Achieving a balance between physical, mental, and emotional well-being is vital for overall health.
27. Different cultures can shape one's perception of beauty and success.



28. Chemotherapy can be an effective treatment for certain types of cancer.

29. Regular practice can help enhance skills and improve performance.

30. Exposure to toxic substances can lead to serious health issues.

Answer

Multiple Choice: 1. Bacterium 2. Inflammation 3. DNA 4. Resistant 5. Chemotherapy 6. Melting point
7. Magnesium 8. Cognitive 9. Dietitian 10. Neuroplasticity

Gap-Fill: 11. ionocaloric 12. refrigerant 13. solvent 14. stress 15. toxic 16. benefits 17. proteins 18. density
19. enhance 20. structural

Matching sentence: 1. Mediterranean 2. brain health 3. nerves 4. muscles 5. inspiration 6. health 7.
perception 8. chemotherapy 9. enhance 10. toxic

CATEGORY

1. Health - LEVEL3

POST TAG

1. B1
2. ESL learning
3. esl news
4. L3
5. Level 3
6. New Method
7. Refrigeration
8. ScienceAlert
9. Scientists Invented

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Author

aimeeyoung99