Scientists Develop Innovative Refrigeration Method

Description

Ionocaloric cooling is a new method for reducing temperatures, potentially offering a safer and environmentally friendly alternative to traditional refrigeration.

Standard cooling systems use fluids that absorb heat when they change from a liquid to a gas and then back to a liquid. However, the refrigerants used in these systems can harm the environment.

In 2023, researchers from the Lawrence Berkeley National Laboratory and the University of California, Berkeley, developed a method that exploits how materials store or release energy during phase changes, such as when ice melts.

Adding ions, or charged particles, can force ice to melt and absorb heat without increasing temperature. This is seen when salt prevents ice formation on roads. The ionocaloric cycle applies a similar principle, using salt to change a fluid's state and produce cooling.

Mechanical engineer Drew Lilley noted that while there are ongoing refrigerant issues, the ionocaloric cycle might address efficiency, safety, and environmental concerns successfully.

The researchers demonstrated that their method could potentially rival current refrigerants by adjusting the melting point using an electric current. Their experiments with iodine and sodium in ethylene carbonate show a significant 25 °C temperature change with less than one volt of electricity.

Ravi Prasher highlighted the potential advantages of this technology regarding environmental impact, efficiency, and cost. Countries committed to reducing hydrofluorocarbons (HFCs) might benefit from this innovation.

The next step is to move the technology from the lab to real-world applications. Researchers are testing various salts to improve heat absorption, with promising results published in 2025 on nitrate-based salts. Prasher emphasizes the need for further experimentation to address engineering challenges.

These findings were published in the journal *Science*.

Vocabulary List:

1. **Ionocaloric** /aɪ.oʊ.noʊ.kəˈlɒrɪk/ (noun): A cooling method that uses the addition or removal of ions to change a material's phase and absorb or release heat.
2. **Refrigerants** /rɪˈfrɪdʒərənts/ (noun (plural)): Fluids used in cooling systems that absorb heat when they evaporate and release heat when they condense.
3. **Ions** /ˈaɪənz/ (noun (plural)): Charged particles (positive or negative) that affect chemical and physical processes; in the article added to cause melting or freezing changes.

4. **Phase change** /feɪz ʧeɪndʒ/ (noun (phrase)): A change between solid liquid and gas states (e.g. melting or freezing) during which a material absorbs or releases energy.
5. **Melting point** /ˈmɛltɪŋ pɔɪnt/ (noun (phrase)): The temperature at which a solid becomes a liquid.
6. **Hydrofluorocarbons** /ˌhaɪ.drə.flʊəˈrɒ.kə.bənz/ (noun (plural)): A class of man-made gases (often called HFCs) used as refrigerants that can damage the environment and are targeted for reduction.

Comprehension Questions

Multiple Choice

1. What is ionocaloric cooling?

   Option: A new type of computer cooling
   Option: A method for reducing temperatures
   Option: A water purification process
   Option: A solar energy technology

2. Which institution developed the ionocaloric cooling method?

   Option: MIT
   Option: Harvard University
   Option: Lawrence Berkeley National Laboratory
   Option: Stanford University

3. What is one of the main advantages of ionocaloric cooling?

   Option: It is less expensive than gas cooling
   Option: It does not harm the environment
   Option: It requires more electricity
   Option: It uses more harmful refrigerants

4. Which element was mentioned in the experiments with ethylene carbonate?

   Option: Potassium
   Option: Iodine
   Option: Calcium
   Option: Magnesium

5. How much temperature change was achieved in the experiments?

   Option: 15 °C
   Option: 25 °C

Option: 30 °C
Option: 10 °C

6. When are the promising results on nitrate-based salts expected to be published?

Option: 2023
Option: 2024
Option: 2025
Option: 2026

True-False

7. Ionocaloric cooling is a traditional method of refrigeration.

8. The ionocaloric cycle uses fluids that change state to absorb heat.

9. Researchers are finding that their ionocaloric cooling method could increase environmental harm.

10. Salt is used in the ionocaloric cycle to change a fluid’s state.

11. The experiments mentioned used only water as a cooling fluid.

12. The findings about ionocaloric cooling were published in the journal Nature.

Gap-Fill

13. Ionocaloric cooling offers a safer and environmentally friendly alternative to traditional

_____ systems.

14. Adding _____ can force ice to melt and absorb heat without increasing temperature.

15. The researchers demonstrated a significant temperature change of _____ °C.

16. The ionocaloric cycle produces cooling by changing a fluid's state using _____.

17. Promising results on nitrate-based salts are expected to be published in _____ .

18. The next step for the research is to move the technology from the lab to _____ applications.

Answer

Multiple Choice: 1. A method for reducing temperatures 2. Lawrence Berkeley National Laboratory 3. It does not harm the environment 4. Iodine 5. 25 °C 6. 2025
True-False: 7. False 8. True 9. False 10. True 11. False 12. False
Gap-Fill: 13. refrigeration 14. ions 15. 25 16. salt 17. 2025 18. real-world

Vocabulary quizzes

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

1. What is the primary function of ionocaloric cooling?
   Option: To heat substances
   Option: To cool substances using ions
   Option: To increase pressure
   Option: To evaporate liquids

2. Which of the following are commonly used as refrigerants?
   Option: Dichloromethane
   Option: Hydrofluorocarbons
   Option: Ethanol
   Option: Acetone

3. What does the melting point refer to?
   Option: Point where a substance starts boiling
   Option: Temperature at which a solid becomes a liquid
   Option: Temperature at which a liquid becomes a gas
   Option: Temperature at which gases condense

4. What is it called when prices for goods and services rise?
   Option: Deflation
   Option: Recession
   Option: Inflation
   Option: Stagnation

5. What type of diet emphasizes fruits vegetables and olive oil?

Option: Ketogenic diet
Option: Paleo diet
Option: Mediterranean diet
Option: Vegetarian diet

6. What is a common cause of an outbreak in a population?

Option: Vaccination
Option: Infection
Option: Hygiene practices
Option: Contamination

7. What is essential for effective disease outbreak detection?

Option: Vigilance
Option: Ambiguity
Option: Fatigue
Option: Indifference

8. What system helps reduce transmission of airborne diseases?

Option: Insulation
Option: Ventilation
Option: Heating
Option: Cooling

9. What term describes contact with harmful substances?

Option: Withdrawal
Option: Exposure
Option: Defense
Option: Immune response

10. Which hormone regulates sleep-wake cycles?

Option: Cortisol
Option: Adrenaline
Option: Melatonin
Option: Serotonin

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

11. The _____ effect can be used to cool materials rapidly.

12. _____ are often considered more environmentally friendly alternatives to older

refrigerants.

13. The _____ diet is known for its heart-healthy benefits.

14. The _____ of ice is 0 degrees Celsius.

15. The _____ of diseases can be significantly reduced with good hygiene.

16. Adequate _____ in buildings helps improve air quality.

17. Prolonged _____ to pollutants can lead to serious health issues.

18. Food _____ can arise from improper handling and storage practices.

19. Chronic _____ can be a response to long-term exposure to irritants.

20. The _____ effects of stress can impact overall health.

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

21. Ionocaloric cooling is an innovative technology leveraging ion movement for efficient temperature control.
22. Hydrofluorocarbons are synthetic compounds used as refrigerants that are considered less harmful to the ozone layer.
23. The Mediterranean diet emphasizes the consumption of healthy fats like olive oil and fresh produce.
24. The melting point of a substance is the specific temperature at which it changes from solid to liquid.
25. Transmission of pathogens can occur through various routes such as airborne direct contact or waterborne.
26. Good ventilation in indoor spaces helps to reduce the concentration of airborne contaminants.
27. Exposure to high levels of pollution can lead to respiratory problems over time.
28. Food contamination can lead to serious illnesses if not addressed promptly.
29. Inflammation is a natural response of the body to injury or infection helping to initiate healing.

30. Cumulative effects of exposure to toxins can lead to chronic health issues over time.

Answer

Multiple Choice: 1. To cool substances using ions 2. Hydrofluorocarbons 3. Temperature at which a solid becomes a liquid 4. Inflation 5. Mediterranean diet 6. Infection 7. Vigilance 8. Ventilation 9. Exposure 10. Melatonin
Gap-Fill: 11. ionocaloric 12. Hydrofluorocarbons 13. Mediterranean 14. melting point 15. transmission 16. ventilation 17. exposure 18. contamination 19. inflammation 20. cumulative
Matching sentence: 1. ionocaloric 2. hydrofluorocarbons 3. Mediterranean 4. melting point 5. transmission 6. ventilation 7. exposure 8. contamination 9. inflammation 10. cumulative

CATEGORY

1. Health - LEVEL4

POST TAG

1. B2
2. ESL learning
3. esl news
4. Level 4
5. Refrigeration
6. scientists

Tags

1. B2
2. ESL learning
3. esl news
4. Level 4
5. Refrigeration
6. scientists

Date Created
2026/03/07
Author
aimeeyoung99