

Product Introduction

[Eco-friendly PCM]

Product introduction

“Dry Ice Substitute”



PCM

Phase Change Material

Method to **effectively maintain** the optimized freezing temperature



Steady frozen
condition



Maintained for
more than 20
hours



Suitable for
packaging
and delivery



Dry ice substitute

Product introduction

Eco-friendly PCM



Product name; **Eco-friendly PCM**

Package material; Laminated nylon or eco-friendly LDPE

Main feature; **Dry ice substitute**

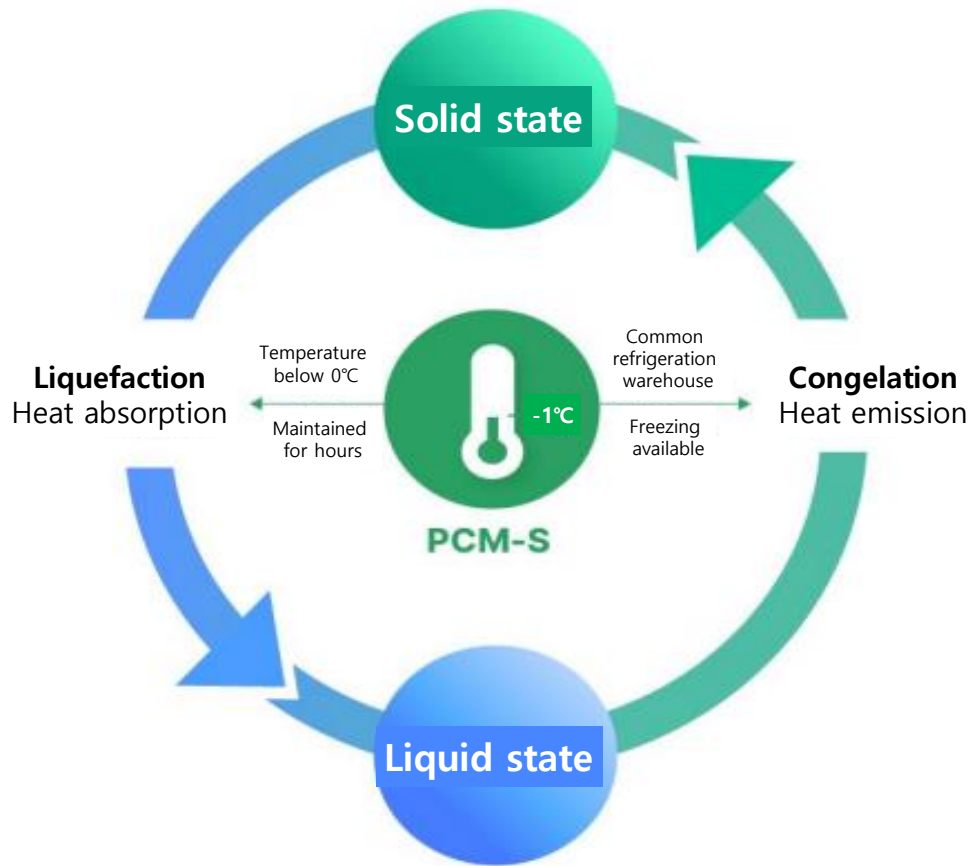
Maximum 20-hour maintenance below -1°C

Freezing available at a common refrigeration warehouse (less than -11°C)

Application; **Cold storage medium (PCM) – freezing point at -11°C**

Dimension; Various types from small (15×20) to large (21×27)

Disposal advantage; The content (PCM) is disposable via household drains like water.



PCM (Phase Change Material)

PCM absorbs or emits heat via the phase change, by external stimulation.

There is little temperature change during this process.

PCM as the cold storage medium

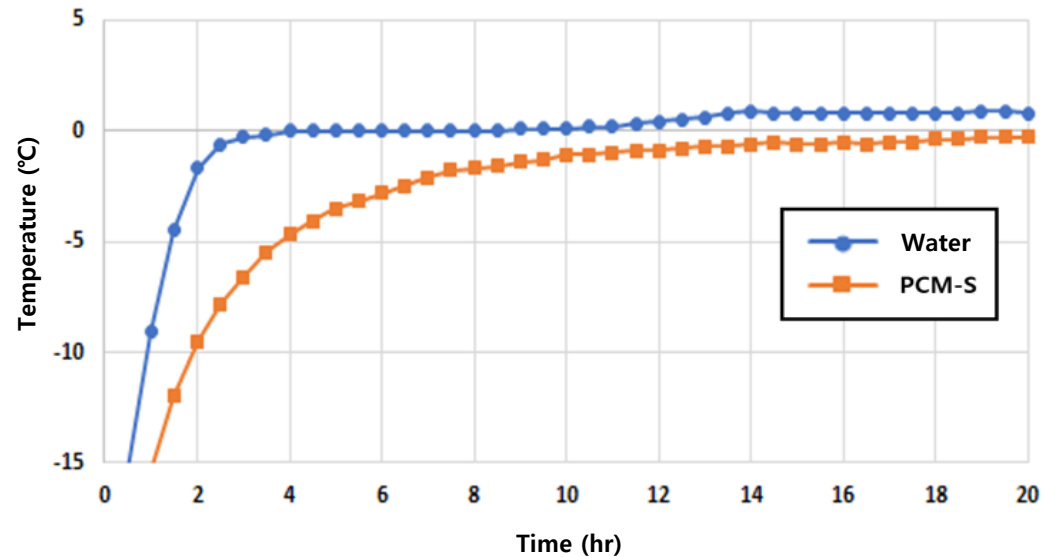
PCM changes its form from liquid to solid by below-zero temperature stimulation and gradually returns to liquid by absorbing adjacent heat.

“Eco-friendly PCM is the substitute for dry ice.”

Ice pack is a **cold insulation** of storing and maintaining the product at around 5°C,

Whereas 'Eco-friendly PCM' is the **cold storage medium** dedicated for frozen products, which maintains the below -1°C temperature for maximum 20 hours.

For the frozen product delivery, using not the ice pack but 'Eco-friendly PCM' will allow the product to be safely stored, and to arrive to the customer side.



Perfect alternative to dry ice!

- 1. -5°C retention time to be more than 300% than water (ice)*
- 2. Maximized below -1°C retention time*

“Eco-friendly PCM has its purpose of safely delivering the frozen product to customers, and is the best alternative to dry ice which is prone to explosion, suffocation, frostbite, etc.”

Supply deficiency of liquefied carbonic acid, the raw material of dry ice, has been intensified worldwide.

While the international oil price surges, and while the petrochemical industries shut down their plant generation, absolute shortage of liquefied carbonic acid is actualized. Dry ice manufacturers cannot even supply the dry ice to existing customers.

Moreover, dry ice manufactured in China shall be conditionally used, with its drawback of having high evaporation volume and deteriorated quality.

PCM is the phase change material that emits cold temperature, and maintains the below-zero temperature at least more than 20 hours. Since it is easy to recycle, PCM has been utilized as the dry ice substitute. If used with dry ice (-70°C), the identical effect can be achieved with much less dry ice.

Product introduction

Eco-friendly PCM

Rankingdak.com, Korea's biggest online platform for frozen goods,
"has 100% adopted Eco-friendly PCM" for delivery

→ As **effective** as dry ice—test by Rankingdak.com: 80-90% equivalent effect confirmed ✓✓

→ High cost-effectiveness compared to dry ice—around 50% price ✓





- ✓ Patent registration (No. 10-2396231, Eco-friendly nano phase change material freezing pack)
- ✓ Excellent **low-temperature persistency, eco-friendly feature** regarding discharging liquid quality
- ✓ Eco-friendly feature 'using 70% PE recyclable resin' (First Green Certification in Korea, GTP-20-02544)



- ✓ Eco-friendly feature confirmed to be 'excellent recyclability' (PE single material product)
- ✓ Excellent **impact resistance, package formability**



- ✓ Patent registration (No. 10-2240272, No. 10-2261130, No. 10-2091593)
- ✓ **70% CO₂ emission reduction** compared to LDPE single material film (carbon neutralization)

'Eco-friendly PCM'

Frozen squid is prepared.



Test condition

Each 500 g 'Eco-friendly PCM' and ice pack(common water) are contained in the separate identical package.

2 of each are placed with the frozen squid inside the Styrofoam box.

Boxes are delivered via Post Office parcel delivery after 25 hours of dispatch.



Test result

Frozen squid using 'Eco-friendly PCM' maintained the condition by almost 90%.

Ice Pack

Frozen squid is prepared.



Test condition

Each 500 g 'Eco-friendly PCM' and ice pack(common water) are contained in the separate identical package.

2 of each are placed with the frozen squid inside the Styrofoam box.

Boxes are delivered via Post Office parcel delivery after 25 hours of dispatch.



Test result

In case of the squid delivered with the ice pack, its shape is loosened and softened, with far less freshness.

Result Comparison

Eco-friendly PCM



Ice Pack



'Eco-friendly PCM'



Test condition

500 g frozen pork belly is packed.

Each 500 g 'Eco-friendly PCM' and ice pack(common water) are contained in the separate identical package.

2 of each are placed with the frozen squid inside the Styrofoam box.

Boxes are delivered via Post Office parcel delivery after 25 hours of dispatch.



Test result

Frozen pork belly using 'Eco-friendly PCM' maintained the condition by almost 90%.

Ice Pack



Test condition

500 g frozen pork belly is packed.

Each 500 g 'Eco-friendly PCM' and ice pack(common water) are contained in the separate identical package.

2 of each are placed with the frozen squid inside the Styrofoam box.

Boxes are delivered via Post Office parcel delivery after 25 hours of dispatch.



Test result

Frozen pork belly using the ice pack changed its form as chilled meat, with almost no frozen condition.

Volume is shrunk by half as shown in the image, with softened shapes.

Result Comparison

Eco-friendly PCM



Ice Pack





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