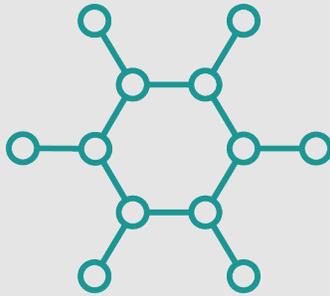


*3 Benefits of*

# Using PCM vs Ice Pouches in Cold Shipment



## What are the benefits of using phase change materials (PCMs) instead of ice for cold shipments?

To demonstrate the benefits of PCMs, **Microtek performed an experiment by sending a package containing chocolate across the country in the middle of summer** and has identified three very distinct benefits that will ensure product integrity while in transport.



# 1. Wider Range of Temperatures

---

Unlike ice, phase change materials have varied and customizable melting temperatures. Ice is great to keep things cold, but what if your product cannot be exposed to freezing temperatures or the critical temperature range is outside the freezing temperature of water? PCMs are designed specifically for these challenges. When working with cold or cool shipment needs, PCMs offer customized temperatures from  $-30^{\circ}$  to  $18^{\circ}\text{C}$ .

---

**“When working with cold or cool shipment needs, PCMs offer customized temperatures from  $-30^{\circ}$  to  $18^{\circ}\text{C}$ .”**

---

In our study, we chose chocolate because it is a temperature-sensitive food that needs to be protected from temperature excursions during shipment. Chocolate should not be frozen and if unprotected from elevated temperatures, melting can cause a change of appearance and loss of integrity. The threshold of  $30^{\circ}\text{C}$  was determined to be the upper temperature limit to protect the chocolates during the shipment. A phase change material with a melt temperature of  $18^{\circ}\text{C}$  was used in parallel with ice to determine what would perform best in keeping the desired temperature range.

# 2. Maintains Temperature Longer

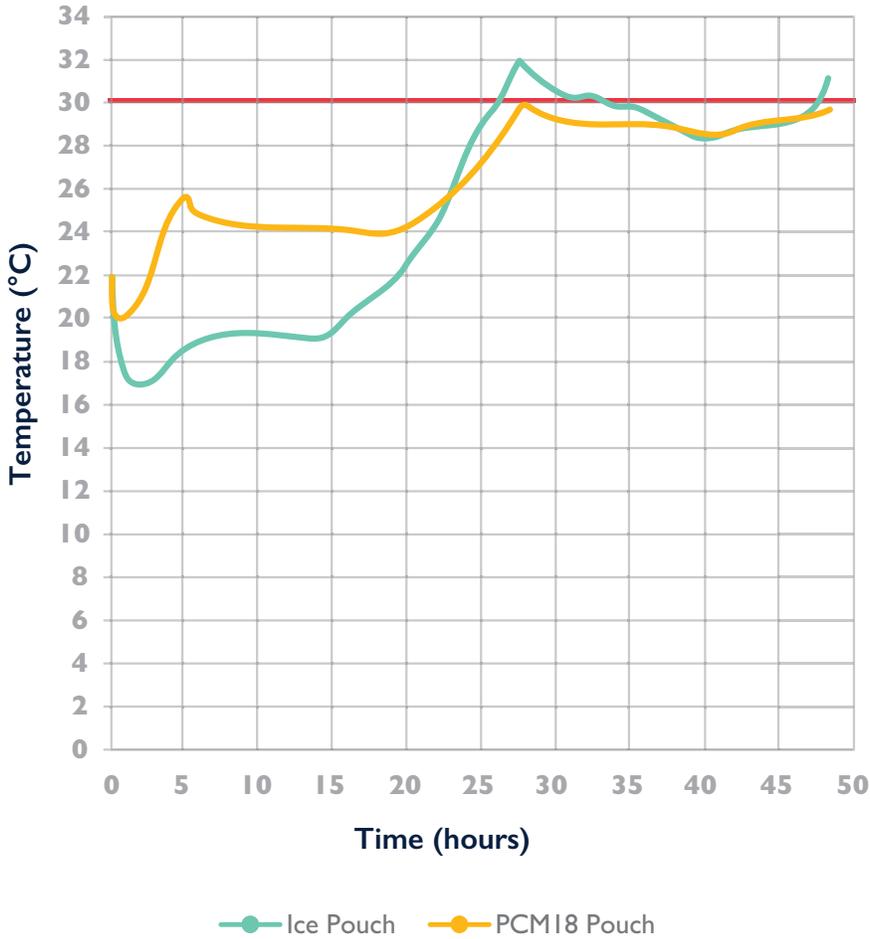
---

Since ice only melts at  $0^{\circ}\text{C}$ , it is limited in its ability to hold temperature as long as other phase change materials – especially when the critical temperature range is above  $0^{\circ}\text{C}$ . This can be clearly seen in our study.

With our chocolate shipment, special care was taken to ensure the packages were constructed the same way. As seen below, shipments were prepared with identical shippers, packing materials and chocolates. The only variation in the boxes was the type of temperature management solution – one contained 318g of ice and the other had 316g of  $18^{\circ}\text{C}$  phase change material. The shipments were packed and sent together via FedEx Ground from Dayton, Ohio to Tampa, Florida.

Care was also taken to ensure the same shipping lanes and conditions. The packages were sent in parallel, so they were both exposed to the same ambient temperatures during transit. As you can see from the graph below, the shipper containing ice worked well for approximately 24-hours. It is safe to predict this is when the ice pouch finished melting. Soon after, we can see the chocolate went above the required temperature threshold of 30°C. In comparison, the shipper with the phase change material kept the chocolate below 30°C for the entire shipment length, over 48 hours.

### Thermal Shipper Study for Chocolates Shipment



The chocolates shipped with ice pouches showed signs of melting, while chocolates shipped with PCM did not. In addition, the PCM started at a higher temperature (2.7°C) than the ice packs (-2.8°C) and still performed better and prevented the shipment from reaching the 30°C threshold.



# PCM Maintains Temperature Longer

ICE



Shipper containing 318g of ice

PCM



Shipper containing 316g of 18°C PCM



Dayton, Ohio



FedEx Ground Shipping



Tampa, Florida

ICE

318g

Single cell filled with ice cubes  
8" X 6"

Freezer at -2.8 C

Thermochill 15" x 13" x 8.75"  
with EPS Foam

Craft paper, two layers on top  
of chocolates

Two plastic containers, with  
~0.45lbs of candy

Mass

Dimensions

Condition

Shipper

Packing Materials

Chocolate

PCM 18

316g

2 x 3 cell design  
10" X 5 - 7/8"

Refrigerator at 2.7 C

Thermochill 15" x 13" x 8.75"  
with EPS Foam

Craft paper, two layers on top  
of chocolates

Two plastic containers, with  
~0.45lbs of candy

# 3. Provides More Value

---

We often hear, “These benefits are great, but how much more will it cost?” While the initial investment for ice packs is lower than that of PCM, our studies show that ice packs cannot protect the product as long or as well, creating added costs in shipping materials, quality loss and overall brand integrity. As mentioned previously, the ice packs stopped protecting the payload approximately 24 hours into the shipment. In comparison, the PCM lasted approximately 48 hours.

---

**“The ice packs stopped protecting the payload approximately 24 hours into the shipment. In comparison, the PCM lasted approximately 48 hours.”**

---

Therefore, if you are using ice packs, the only way to guarantee your shipment arrives within the desired temperature range is to shorten the shipping lane. On average, overnight shipments can create almost 300% more in shipping fees to accomplish the same goal. This added cost will continue shipment after shipment, adding exponentially more in shipping fees than the initial investment of the PCM. In addition, PCM's are recyclable and can be reused within your supply chain a number of times.

## Conclusion

While ice packs work for many logistic scenarios, it is important to identify all of the factors and costs involved in transportation lanes before settling for a solution. When all aspects of the project are identified PCM's are often a better solution, providing your brand with a more versatile, safer and valuable alternative.

Want more information? As a leading provider of thermal management solutions, Microtek offers a wide array of thermal management solutions. As manufacturers continue to introduce innovative new products, it is imperative that logistics keeps pace to ensure safe and affordable delivery. Because of this, we are continually driven to provide innovative technologies, customer satisfaction and brand protection.

### CONTRIBUTING AUTHORS:

*David Haan*  
*Marketing Manager*

*Colleen Costello*  
*R&D Senior Scientist-Manager*

**microteklabs.com | 888.256.3191**  
**info@microteklabs.com**

**microtek**  
laboratories, inc.