

## ❖ Improving Freezing Efficiency in Bakery Products Using Air – O – Film Perforated Stretch Film

### Cooling Time Comparison of Bakery Products Wrapped in Conventional Stretch Film and Air – O – Film Perforated Film

#### 1. The Challenge

Bakery producers rely on efficient freezing to maintain product quality and production throughput. However, conventional solid stretch film can restrict airflow around wrapped trays or pallets, potentially slowing the cooling process and extending freezing times.

The challenge was to determine whether **Air – O – Film perforated stretch film could improve airflow and reduce the time required for bakery products to reach target freezing temperatures.**



#### 2. Objective

To evaluate the **impact of packaging film type on freezing performance** by comparing the cooling time required for bakery products wrapped with:

- **Conventional solid stretch film**
- **Air – O – Film, Perforated stretch film**

The study focused on the **time required for products to reach specific internal temperature levels during freezing process.**

#### 3. Test Setup

**Product:** Standard bakery items (representative production batch)

**Packaging:**

- Carton boxes
- Air – O – Film Perforated stretch film & Solid Stretch film

**Freezing conditions:**

- Low Temperature freezer environment (**-18°C**)
- Identical product load and configuration
- Core temperature measured using calibrated temperature loggers

**Temperature targets measured:**

- **5°C → -13°C**

All trials were performed under **identical operating conditions** to ensure reliable comparison.

## 4. Results

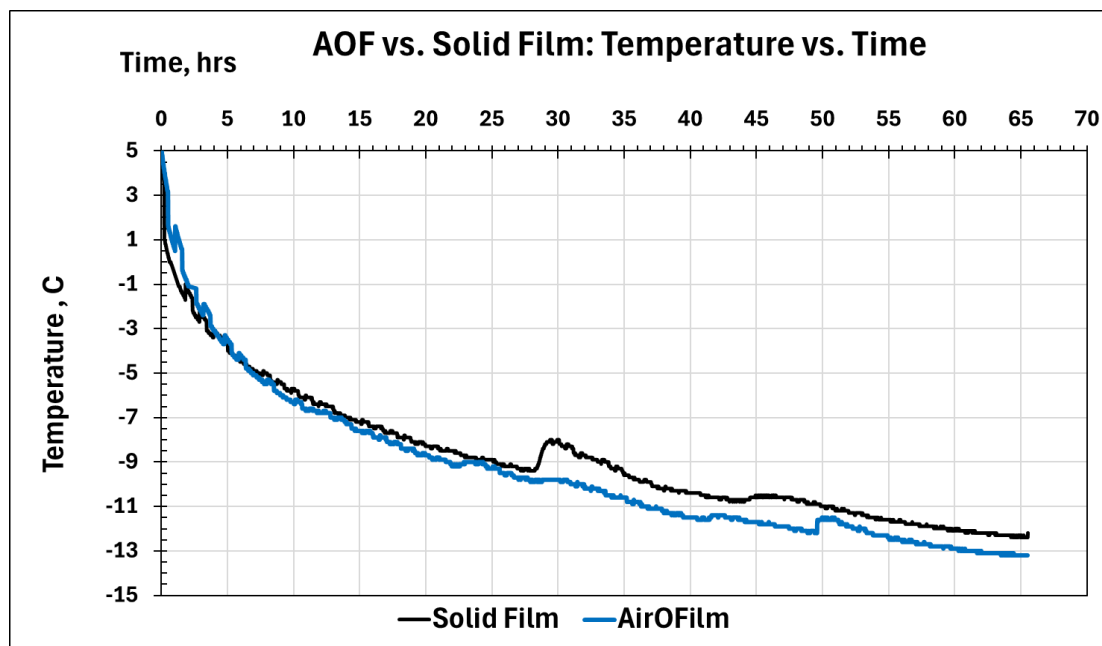
### Key Observation:

Products wrapped with Air – O – Film, Perforated stretch film, cooled significantly faster than those wrapped with conventional film.

Solid Film vs. Air – O – Film Perforated Film, Cooling Time vs. Temperature is illustrated below:

Target Temp. C	SOLID FILM	AOF	$\Delta$ , Hrs.	$\Delta$ , %
-9C	25,0 hrs.	22,0 hrs.	3,0 hrs.	-12%
-10C	37,0 hrs.	31,0 hrs.	6,0 hrs.	-16%
-11C	49,5 hrs.	37,0 hrs.	12,5 hrs.	-25%
-12C	59,5 hrs.	47,0 hrs.	12,5 hrs.	-21%
-13C	N/A	60,5 hrs.	-	0%

Overall freezing time reduction: **up to 25% faster cooling**



## 5. Key Benefits

Using Air – O – Film Perforated Stretch Film during freezing can deliver several operational advantages:

- ✓ Improved airflow around products
- ✓ Faster heat transfer and cooling
- ✓ Reduced freezing cycle time, up to 25%
- ✓ Potential increase in freezer throughput
- ✓ Maintained product protection during handling