



CLEAN LABEL PIZZA TOPPINGS

APPEAL TO CONSUMERS

Today's consumers love pizza, especially with pepperoni on top—and they love it even more, when it comes with a cleaner label.

CONSUMERS AND PIZZA

#1 PEPPERONI:
most-ordered topping
on pizza¹

#1 CLAIM
of new pizza product
launches: **no additives/
preservatives**²

CONSUMERS AND CLEAN LABELS

Consumers surveyed
said that a **clean label**
is a “very important”
label claim.³

A “**clean**” label often
equates to **recognizable
ingredients**.

DID YOU KNOW?

84% of pizza sales are frozen pizzas.²

A **cleaner label frozen pizza** without
synthetic preservatives can help
counter the perception that
certain frozen prepared foods
are over-processed.



THE GOAL

Crave-worthy pepperoni and pizza toppings that stay fresher longer,
with label-friendly ingredients

MEATING THE CHALLENGE

PROTECTING COLOR & FLAVOR IN PIZZA TOPPINGS, WITH NATURAL PLANT EXTRACTS

THE CHALLENGE

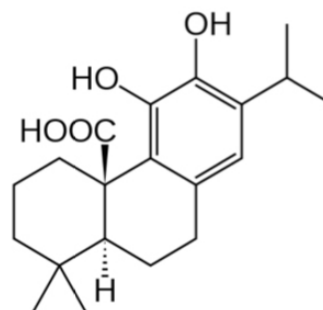
Oxidation results in color changes (that impact consumers' initial purchases) and flavor changes (that impact their repeat purchases).

When it comes to quality and consumer acceptability, **pepperoni and other meat-based pizza toppings present their own set of challenges** that manufacturers need to consider: the **high fat and salt content, and the challenges of freezing, oxygen and light conditions**, combined. Another factor? Using paprika as an ingredient, because its highly conjugated double bond carotenoids, can degrade and cause color to rapidly fade.

Synthetic antioxidants such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and citric acid have traditionally been used to preserve color and flavor during shelf life. **As consumer preferences begin to shift towards clean label products, natural plant extracts can be used in place of synthetics as an alternative option.**

THE PROCESS

Carnosic acid is the active ingredient of rosemary extract. It helps control oxidation by quenching free radicals to delay color and flavor changes in many food applications.



Carnosic Acid

At our **Customer Laboratory Services (CLS)** facility, we compared the impact of various rosemary extracts (CA-FORT™) vs. traditional synthetic antioxidants on the color and flavor stability of sliced pepperoni.

Our CLS team conducted a series of analytical tests, documented with digital photographs, to measure progress:

- Hunter a^* Colorimeter, measuring impact on color loss

THE FRESHER, SAFER, LONGER EXPERTS

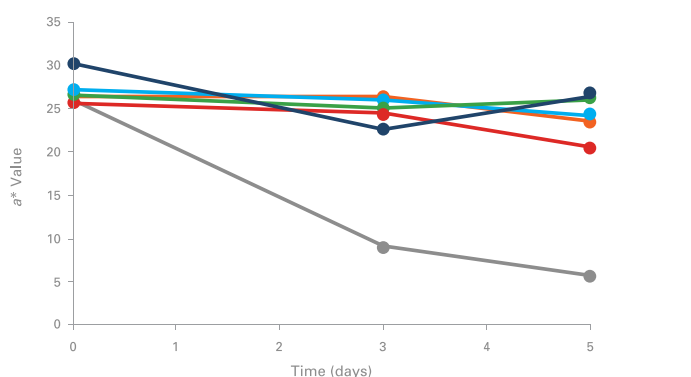
THE RESULT

This study confirmed that natural plant extracts were able to provide oxidative stability to pepperoni's color and flavor among various storage conditions, over time.

AMBIENT AND LIGHTED STORAGE

While most treatments reached an unacceptable loss of redness by day 3, CA-FORT™ 1085 with 75 ppm and 100 ppm carnosic acid concentration showed one additional day of acceptable color.

Hunter a^* Values



Negative Control CA-FORT 1085 (50 ppm CA) CA-FORT 1085 (75 ppm CA) Competitor Product (75 ppm CA) CA-FORT 1085 (100 ppm CA) EN-HANCE A121S + EN-HANCE CA (30 ppm each BHA/BHT/Citric Acid)

*CA-FORT dosages vary per treatment and were standardized to Carnosic Acid (CA) content for comparison purposes.

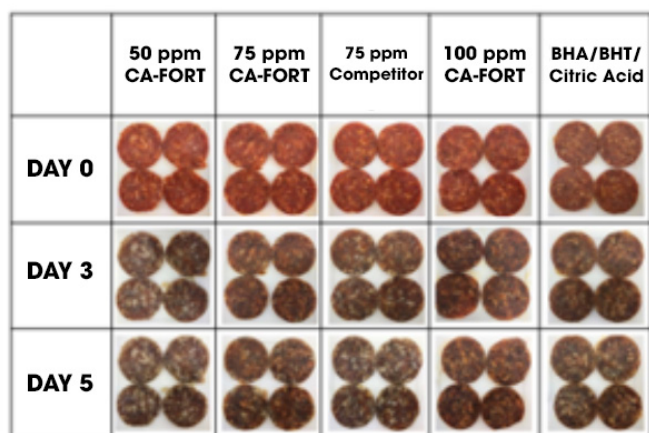
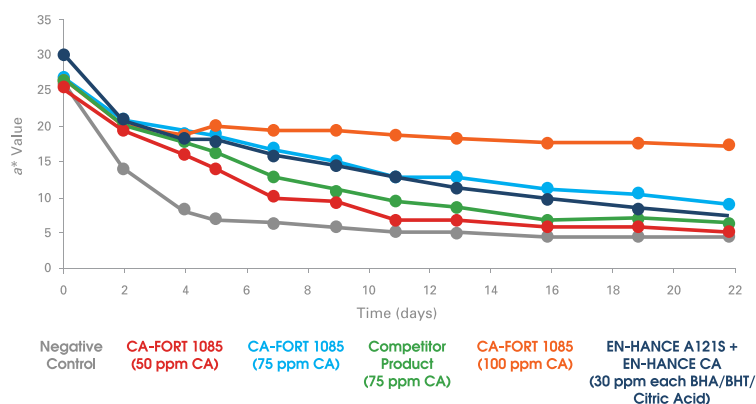


Figure 1. Pepperoni slices day 0, 3, and 5 for lighted ambient (20-22 °C, 2550-3550 Lux). Treatments from left to right are 0.059% CA-FORT 1085 (50 ppm CA), 0.088% CA-FORT 1085 (75 ppm CA), 0.088% Competitor Product (75 ppm CA), 0.118% CA-FORT 1085 Dry (100 ppm CA), and 0.015% EN-HANCE A121S + 0.006% EN-HANCE CA (30 ppm each BHA/BHT/Citric Acid).

REFRIGERATED AND LIGHTED STORAGE

Hunter a^* values showed that CA-FORT™ at 100 ppm carnosic acid concentration was the best option under simulated retail meat case conditions and that rosemary extract alone (with carnosic acid concentration between 60-100 ppm) provided equal or greater oxidative stability in pepperoni than the BHA/BHT/citric acid combination.

Hunter a^* Values



*CA-FORT dosages vary per treatment and were standardized to Carnosic Acid (CA) content for comparison purposes.

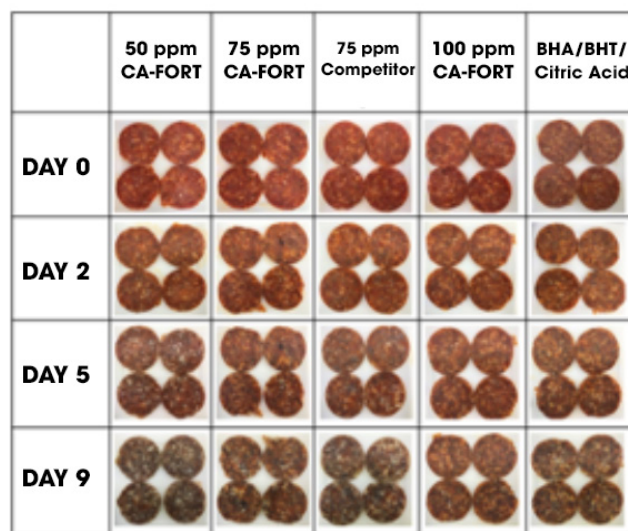


Figure 2. Pepperoni slices day 0, 2, 5, and 9 of refrigerated storage, under a light intensity of 800-1350 Lux. Treatments from left to right are 0.059% CA-FORT 1085 (50 ppm CA), 0.088% CA-FORT 1085 (75 ppm CA), 0.088% Competitor Product (75 ppm CA), 0.118% CA-FORT 1085 Dry (100 ppm CA), and 0.015% EN-HANCE A121S + 0.006% EN-HANCE CA (30 ppm each BHA/BHT/Citric Acid).

THE SOLUTION



Carnosic acid (CA-FORT™ 1085 Dry) displayed comparable efficacy in delaying oxidation and the loss of redness in pepperoni to traditionally used synthetic options (BHA/BHT/citric acid).

When compared to a competitor's product with a similar concentration of carnosic acid, 75 ppm CA-FORT™ 1085 slowed color loss and the formation of malondialdehyde (MDA) with equal or greater efficacy, demonstrated with color analysis (a^*) and photographs.

INGREDIENTS

- ▶ Rosemary extract (CA-FORT™)

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