

## Study Proves Modified Atmosphere Packaging Makes A Difference

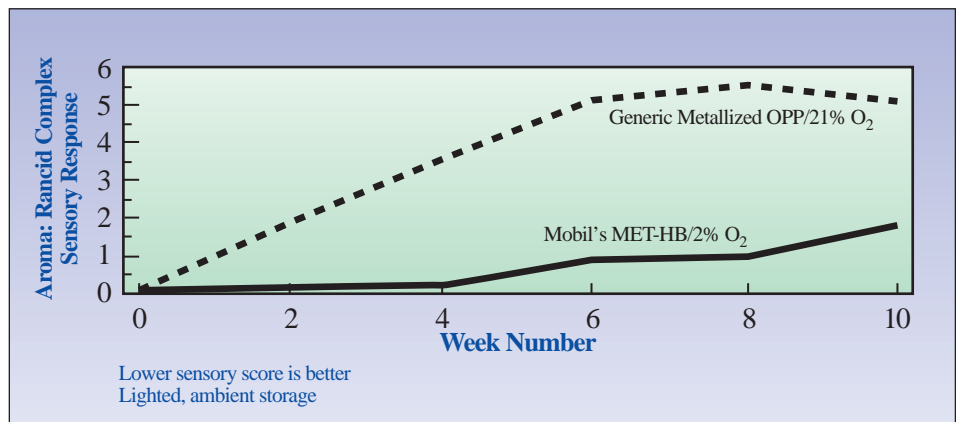
Praxair and Mobil Chemical Films Division jointly sponsored a potato chip modified atmosphere packaging study, conducted by Kansas State University's Sensory Analysis Center. The study utilized plain potato chips fried in liquid corn oil. Six-hundred six-ounce, fin-sealed bags of potato chips were made at a manufacturer's plant on a Hayssen Ultima vertical form, fill and seal machine utilizing horizontal crimpers. The packaging machine was retrofitted to provide nitrogen for

some test variables. Nitrogen was used to displace the air in packages to obtain desired headspace oxygen levels.

The study provides valuable information regarding modified atmosphere packaging using various film structures, initial package headspace oxygen concentrations and storage conditions. Sensory data were gathered on 13 combinations of controlled variables. The following graphs present key data from the study.

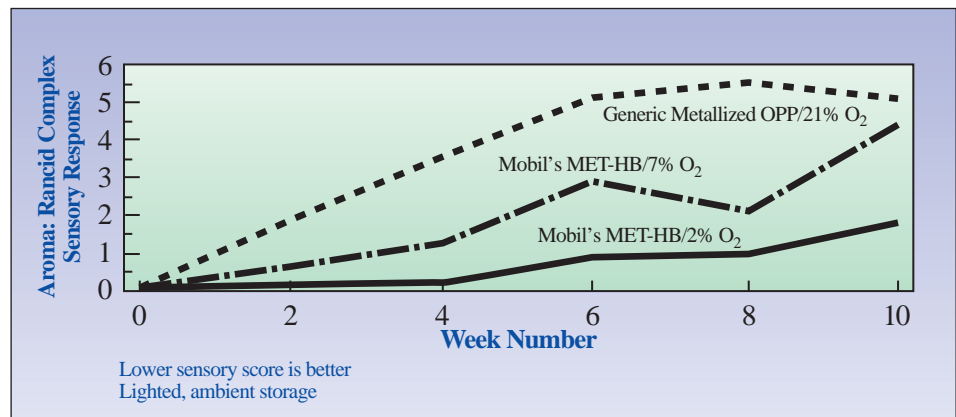
**Q.** Does nitrogen flushing with high-barrier packaging really make a difference?

**A.** Yes. Nitrogen flushing with high-barrier, metallized packaging can significantly deter the development of rancid odors and flavors with potato chips due to oxidation as indicated by the favorable sensory response of Mobil's MET-HB/2% O<sub>2</sub> as compared to generic (not high-barrier) metallized packaging with air (GMET/21% O<sub>2</sub>).



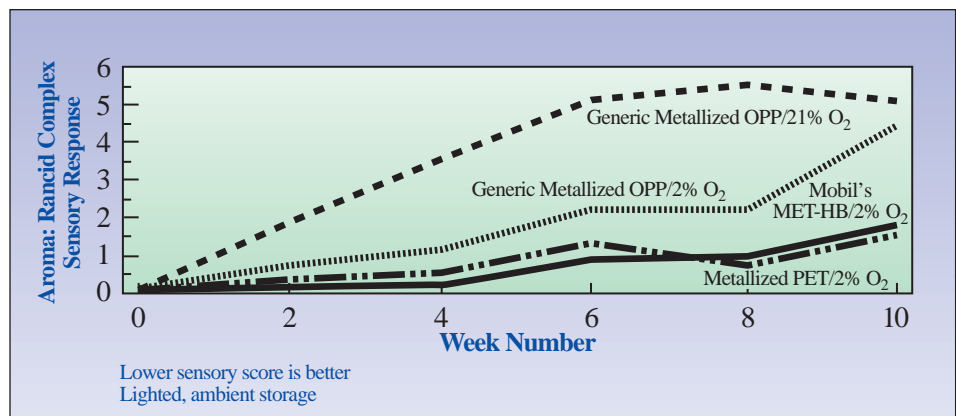
**Q.** What initial headspace oxygen concentration is needed to get improved results?

**A.** The easily achievable initial oxygen level of 2% provided significant improvement. Even 7% oxygen yielded an improvement.



**Q.** What films provide the greatest benefits?

**A.** Nitrogen-flushed, high-barrier metallized oriented polypropylene (like Mobil's MET-HB) and metallized polyester (METPET) were the best of the films tested and indistinguishable from each other. Even a generic metallized oriented polypropylene with 2% oxygen yielded an improvement and performed better than any of the test structures with air.

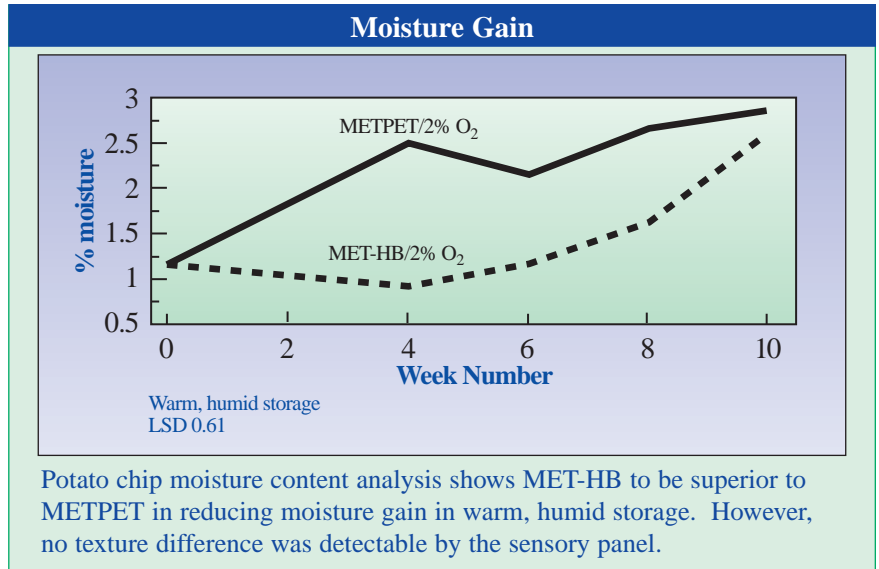


**Q.** Will nitrogen flushing reduce moisture gain or improve texture?

**A.** All other things being equal, nitrogen flushing did not measurably affect moisture content or crispness.

**Q.** Does nitrogen flushing eliminate the need for light barrier?

**A.** No. Light barrier is very important. The clear, high-barrier, PVdC-coated oriented polypropylene developed rancid notes very rapidly even though the packages consistently maintained the initial 2% oxygen.



### Sensory Evaluation

Six highly trained panelists at Kansas State University's Sensory Analysis Center were used to distinguish perceivable differences following ASTM standards. Each test variable was randomly replicated three times at each sitting. Data were gathered on 32 response variables. The "aroma: rancid complex" response variable was used in presenting the data. Rancid complex includes aromatics associated with oxidized fats and oils described as cardboard, painty, varnish-like and fishy.

The sensory data were used in calculating Fisher's least significant difference (LSD), a measure of statistical significance. Using a 95% confidence level, the LSD for "aroma: rancid complex" was 1.83. If "aroma: rancid complex" data points are separated by more than 1.83, the difference is significant.

Controlled Variables
<b>Initial Headspace Oxygen Level:</b> 21% (air) 7% 2%
<b>Storage Conditions:</b> Lighted, ambient Warm, humid (85° F/80%RH)
<b>Inner Web Of Packaging:</b> GMET: Generic metallized OPP <sup>1</sup> MET-HB: Mobil's high-barrier metallized OPP <sup>1</sup> HBS-2: Mobil's clear high-barrier PVdC-coated OPP <sup>1</sup> METPET: Metallized polyester <small><sup>(1)</sup> Oriented polypropylene</small>
Sensory data were gathered on 13 combinations of controlled variables.

Barrier Properties			
Packaging <sup>1</sup>	Optical Density	OTR <sup>2</sup>	WVTR <sup>3</sup>
GMET	1.5	7.0	0.04
MET-HB	1.9	1.3	0.01
METPET	2.2	0.12	0.08
HBS-2	n/a	0.34	0.14

Flat sheet barrier properties of test structures.

- Lamination: 75 gauge LBW/7 lbs. LDPE/Inner Web
- Oxygen transmission rate: cc/100 in<sup>2</sup>/24 hrs. @ 23° C/0% RH
- Water vapor transmission rate: gm/100 in<sup>2</sup>/24 hrs. @ 100°F/90% RH

**If you would like to adopt modified atmosphere packaging in your process or want more information, call 1-800-PRAXAIR.**