

CHUB INNOVATIONS

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High on low oxygen

A joint effort to develop low-oxygen ground beef chub packaging conceives new possibilities for the fresh meat industry.

While modified atmosphere packaging (M.A.P.) is largely associated with high-oxygen systems, a new low-oxygen alternative for ground beef chubs may contribute to improved food safety and extended product shelf life.

Bradley, CA-based Henry & Sons Inc., Clear Lam Packaging Inc.'s MAP Systems Division, Elk Grove Village, IL, and Packaging Technologies, Davenport, IA, have collaborated to develop and

study a ground beef chub package derived from Packaging Technologies' KartridgPak ChubMaker, Henry & Sons' AC-30 stuffer, and Clear Lam Packaging's chub film and gas flush system interface.

"Henry & Sons' relationship with Packaging Technologies has been ongoing for years with many installations of chub packaging lines," notes Mark Henry, vice president of Henry & Sons. "MAP Systems/Clear Lam came into the picture with its knowledge of food safety and gassing technology, as well as being a manufacturer of rollstock film."

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*- Mark Henry, vice president,
Henry & Sons*

Chub economics

From Henry & Sons' perspective, the low-oxygen ground beef chub project was an opportunity to extend the shelf life of vacuum-stuffed products. “Our objective is to further extend food safety as well as product shelf life, giving our customers farther distribution destinations,” Henry notes, also pointing to chub packaging costs versus those of high-barrier tray packs. “The overall packaging cost is half of the tray pack.”

Mark Lowden, KartridgPak product manager, further stresses that while the cost for tray packaging materials is more than chub film, the KartridgPak ChubMaker also produces up to 120 packages per minute of one-pound packages, 80 to 90 packages per minute of two-pound packages, and 60 to 70 packages per minute of three-pound packages – greater production speeds than any tray packaging

system can achieve.

“As tray-packaged ground beef that had been gassed was growing, one thing dramatically changed for the consumer, and that was that the price per pound for ground beef rose dramatically,” adds Lowden. “[Packaging Technologies] was interested in finding a way to get the consumer a good-quality ground beef product at a more reasonable cost. With the KP ChubMaker as the most economical way to package ground beef, Packaging Technologies partnered with MAP Systems and Henry and Sons to offer an integrated solution that delivers and extends shelf life product to our customers, and theirs.”

In addition to material and production considerations, Henry says processors may experience significant savings related to shipping costs. “The overall findings were substantial savings resulting in greater profits for processors. By shipping chubs [processors] can ship a complete truck load. By shipping tray packs, only one half a load can be shipped,” he contends. “For example, a tray pack that is two inches thick with one inch of meat results in wasted space. Therefore, a truck load is only carrying half the amount compared to a truck carrying a full load of chubs.”

Why low oxygen?

Ground beef chub project participants also point to shortcomings related to the indus-

try's competing – and more prevalent – high-oxygen M.A.P. systems as a driver behind their efforts.

“The M.A.P. technique that is being used by the industry – high oxygen – did not always help achieve the shelf life needed to meet the demanding needs of warehousing, distribution, and retail storage for many large packers and their retail chain clients. The shelf lives were limited due to early signs of spoilage, which includes off odors, slime, texture change, and color deterioration,” says Silvana Krueger, resident food scientist for MAP Systems. “A low-oxygen M.A.P. environment can prevent gram negative aerobic bacterial growth, inhibit signs of aerobic spoilage, inhibit mold growth, prevent oxygen degradation, retard oxidative rancidity in fatty meats, and reduce shrinkage by preventing water loss.”

Steve Butterfield, vice president of sales and marketing for MAP Systems, notes that low-oxygen packaging in the fresh meat industry has not been readily embraced by the American market due to consumers' insistence on buying oxygen-rich meat that has “bloomed,” achieving the bright red color they enjoy. In earlier efforts to overcome this obstacle, MAP Systems in spring 2001 conducted a test to determine whether re-bloom is possible after product is packaged in a low-oxygen environment and later re-exposed to an ambient oxygen environment. At the study's end, it was determined that when packaged at a range

• The results are in •

Low-oxygen ground beef chub packaging maintains acceptable microbial counts and organoleptic qualities for up to 48 days.

One-pound ground-beef chubs manufactured by Henry & Sons, Packaging Technologies, and MAP Systems in a low-oxygen (0.08 - 0.3 percent) modified atmosphere packaging format recently were analyzed for microbial integrity during a 50-day holding period by San Antonio, TX-based Food Safety Net Services. The packaged product was stored at 28°F for 30 days at the laboratory, then moved to 40°F storage for the duration of the study to simulate the temperature range anticipated during shipping and retail display. Intended to determine how long the meat's microbial and organoleptic qualities, including appearance, odor, taste, and texture, would remain within an acceptable or tolerable range, the study's findings included the following:

- *Aerobic plate counts as well as anaerobic plate counts were well within acceptable ranges for the 50-day holding period.*
 - *Lactic acid bacteria counts were acceptable through day 48, with an increase in these populations observed on day 50.*
 - *Total coliform levels were within acceptable levels for the first 48 days of the study. By day 50, coliform levels reached an unacceptable range.*
 - *Yeast and mold levels were acceptable for the 50-day holding period.*
 - *The pH of the product was acceptable during the study; pH levels decreased as the holding period increased.*
 - *Organoleptic qualities were acceptable through day 48, with some browning of the product and slight purge noted on day 48.*
- By day 50, an off odor also was noted.*

Actual lab report/data is available to anyone interested in actual counts and can be obtained by contacting any of the three companies involved in the study. "These studies have indicated that extended shelf life may be available to meet the demands of longer warehousing/storage," says Mark Henry, vice president of Henry & Sons. "Low-oxygen modified atmosphere packaging, while overcoming the issues that may have been a concern in the past, can achieve this."

of .08 to 0.3 percent oxygen, fresh ground beef enters a deoxy-myoglobin (purple) state within three to five hours, which is necessary to achieve re-bloom.

"When initially packaged at this oxygen range (.08 to 0.3 percent), the fresh ground beef returned to a red/pink color after five to six minutes of ambient air exposure," adds Krueger. "Once we found promising results that will overcome the issue of color, we decided to move forward with this study to overcome the other big questions that often come with low-oxygen packaging for fresh meat: Will the product be safe microbially, with particular concerns for anaerobic/lactic acid growth? And what kind of effect does low oxygen have on the meat product?"

Study specifics

The low-oxygen ground beef chub packaging study was conducted at a West Coast-based full-production meat packaging facility in the spring and summer of 2003. Product was held and tested by San Antonio, TX-based Food Safety Net Services Ltd., chosen for its ISO and USDA accreditations as well as its extensive research experience in the fresh meat industry.

One-pound, fine-grind chubs were gas flushed with a proprietary carbon dioxide and nitrogen blend, with residual oxygen levels in the packaged chubs targeted at a range of .08 to 0.3 percent. The ground beef was

gas flushed in the stuffer and again at the chub machine to maintain the low oxygen levels up to the point at which the material is formed over the meat into a chub package.

The meat was packaged and held unfrozen at 28°F for 30 days to simulate warehousing and shipping conditions, then stored at 40°F an additional 20 days to simulate retail storage and display. Product was tested at 9 different points throughout the 50 days for aerobic plate count, anaerobic plate count, total coliforms, lactic acid bacteria, yeast, mold, pH and organoleptic analysis, including confirmation of re-bloom.

"This study was not conducted to establish shelf-life limits on ground beef, but to evaluate the effects of low oxygen on the product. Shelf-life determination needs to be conducted by any company interested in entering into a low-oxygen packaging format," Butterfield notes. "The quality of the incoming goods, plant cleanliness, air cleanliness and cold chain distribution/integrity all impact the final shelf life of a product. Pathogens were not tested during this study; because the product was packaged under the assumption that incoming meat is free of pathogens and packaged by USDA standards and regulations and within current Good Manufacturing Practices."

The study revealed, nonetheless, that all microbial counts and organoleptic analyses were well within acceptable parameters after 30 days at

28°F. Moreover, all counts and analyses remained within an acceptable range after being transferred to 40°F for an additional 18 days. By day 48, slight purge was noted and some samples did not achieve full bloom after air exposure. By day 50, lactic acid and coliform counts were unacceptable.

The study, participants agree, indicated that extended shelf life may be achieved to meet the demands of longer warehousing/storage through the use of low-oxygen M.A.P. technology. "In short, we were able to take a 21-day conventional shelf life and extend it in excess of 45 days for a retail fine grind ground beef chub," Henry concludes. "Although this new system to extend shelf life is in its initial stages, we feel it can be used for many different products other than ground beef, producing substantial savings not only for the manufacturer but also the consumer."

The bottom line

Henry refers to the new, low-oxygen ground beef chub packaging as a "re-innovation of the chub packaging system," predicting that the system ultimately will be used for applications other than ground beef, such as dairy, pork, and poultry – in other words, any perishable product utilizing chub packaging.

The system's uniqueness in the marketplace bodes well for its future success. "There is no existing technology like this. This is the first time a chub has been successfully mapped to these levels using an open system," say Henry. "It offers the lowest per package cost from any other means of packaging. Currently, tray pack competitors blanket the meat with inert gas which gives a shelf life of a maximum of eighteen to twenty days. The equipment to do this is very expensive and labor intensive. Our new system offers not only less equipment, less labor, increased production per hour and less work space, but it also vastly extends the shelf life of the product."

The players and their parts

Henry & Sons', Packaging Technologies', and MAP Systems' collaboration to produce a low-oxygen (0.08 - 0.3 percent) ground beef chub package on a continuous open grind system includes the following components:



· Henry & Sons AC-30 stuffer features special devices for purging the hopper with inert gas, as well as completely penetrating product. The company manufactures the stuffer and gas-injecting devices, for which it holds patents.



· MAP Systems manufactured the patented system for disbursing the gases, the gas distributing and mixing panel, and the gassing interface, which purges all air from the perimeter of the product beneath the packaging. MAP Systems' dual laminar patented technology brought the oxygen levels down to the needed range (below 0.3 percent) to initially bring the product into an immediate deoxy-myoglobin state to assure re-bloom. The oxygen was effectively driven out to avoid high residual oxygen that often appears during out-gassing, before the product reached an oxygen equilibrium state, from the small pockets in the fine grind. Clear Lam Packaging supplied the film.



· Packaging Technologies continuous-motion chub manufacturing machinery is known as the KartridgPak ChubMaker.

For additional information regarding the low-oxygen ground beef chub packaging system, please contact the following companies:

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MAP SYSTEMS

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