How LifeSpan MAP Works

The fundamental technology in LifeSpan focuses on creating a beneficial modified atmosphere inside the LifeSpan package, and then maintaining this MA for an extended period.

The identification of a beneficial MA must be determined first. As every type of produce has unique postharvest responses, LifeSpan employs specialists in postharvest plant physiology to identify beneficial MA as part of designing every LifeSpan product.

The beneficial MA is maintained over an extended period due to a physical equilibrium. In Figure 1, the components of a LifeSpan application are depicted. Two atmospheres are present, air exists outside the LifeSpan package and the beneficial MA exists inside the LifeSpan package. The concentration differences across the LifeSpan package wall provide the drivers to move oxygen into the package and to move carbon dioxide out of the package. Inside the package, the produce is respiring at a suppressed rate due to the beneficial MA. In total, the produce is absorbing oxygen at a consistent rate, and releasing carbon dioxide at another consistent rate. To keep the atmosphere inside the LifeSpan package constant, the rate of oxygen entering the package must be the same as the produce absorption of oxygen, and the rate of carbon dioxide leaving the package must be the same as the produce release of carbon dioxide. The film permeability of the LifeSpan package is designed and manufactured to control the rate of gas transfer to match the rate of produce respiration.

Note that this is not an instrumented control process. Due to minor variations in the weight of produce packed, the storage temperature of the produce, the permeability of the LifeSpan package as manufactured, and the variations inherent in a natural product such as fresh produce, then the actual oxygen levels obtained in any LifeSpan package will vary by ± 2.0% 0_2 about the designed value, and the actual carbon dioxide levels obtained in any LifeSpan package will vary by ± 1.5% $C0_2$ about the designed value.

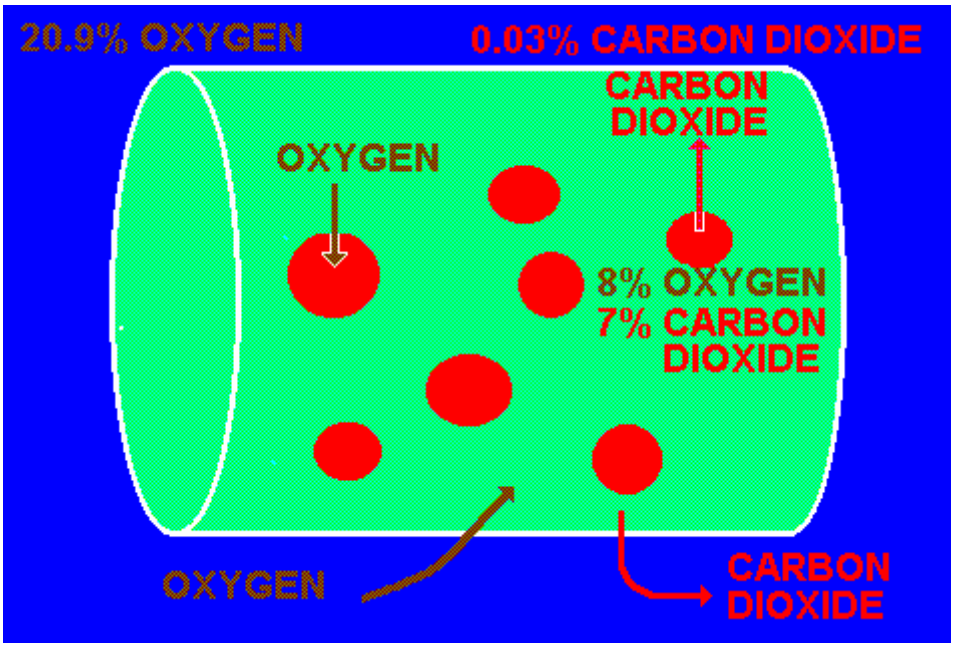

Figure 1 Gas Diffusion in LifeSpan MAP

Passive and Active Modification

There are two stages in the life of a modified atmosphere package. The first stage involves creating the atmosphere and therefore involves altering the oxygen and carbon dioxide levels in the package, and the second stage involves maintaining the modified atmosphere over an extended period.

One of the commercial advantages of LifeSpan packages is our ability to use the natural respiration of the produce to set up the modified atmosphere. This alleviates the need for expensive gases, gas flushing equipment, labour to operate the equipment, and a bottleneck on the packing lines. For most produce and applications, LifeSpan packages merely need to have the excess headspace air pushed out and the package sealed gas tight.

At the time of sealing, the internal atmosphere is air and the produce is respiring at the (higher) rate associated with air. However, the LifeSpan package has been designed for a lower respiration rate that exists under a modified atmosphere. Also, initially there is no gas concentration difference across the wall of the LifeSpan package - there is air on both sides. Hence there will be no transfer of oxygen into the package and no transfer of carbon dioxide out of the package. Respiration by the produce uses up oxygen within the headspace of the LifeSpan package and the oxygen level will begin to decline from 20.9%. Respiration by the produce releases carbon dioxide into the headspace of the LifeSpan package and the carbon dioxide level will begin to rise from 0.03%. The atmosphere is modifying passively. The rate of modification is high at first, but as it continues, the modified atmosphere will start to suppress respiration rate. At the same time, there is a growing concentration difference for each gas across the wall of the LifeSpan package. Hence there is an increasing rate of gas diffusion through the walls.

In an ideal situation, the rate at which the atmosphere modifies will slow with time and eventually the MA will stabilise at the designed values for oxygen and carbon dioxide. In practice, the MA quite often overshoots the designed values and then drifts back to the long term equilibrium MA. This occurs as the modification happens at a rapid pace and there is a substantial lag in the change in respiration rate.

It is important that this passive modification is monitored in development trials to ensure any overshoot does not switch the produce into anaerobic respiration.

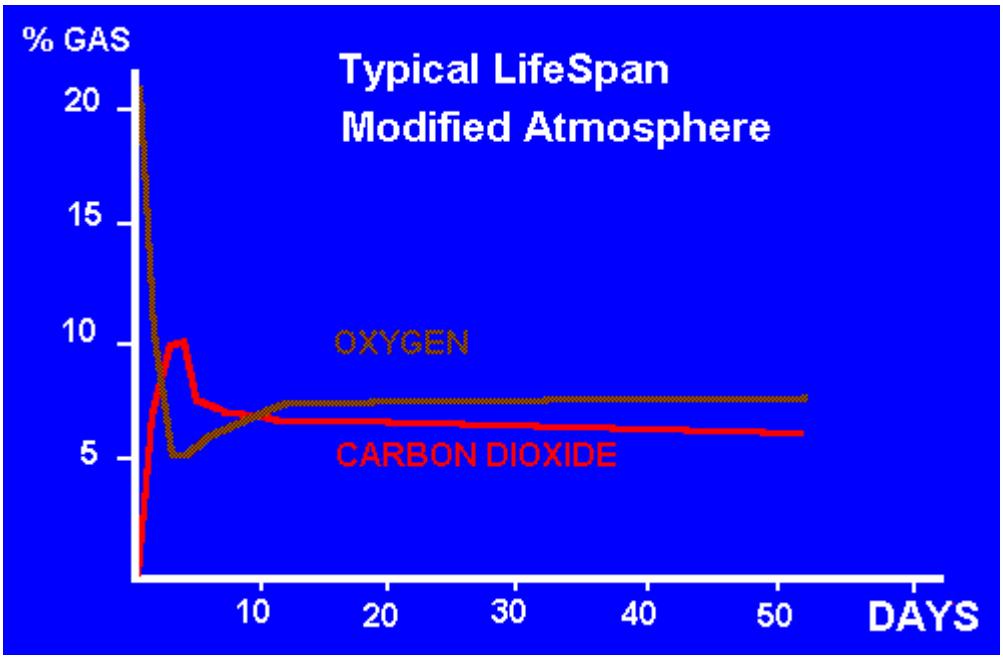

Figure 2 Typical Passive Modification in a LifeSpan Design

For most LifeSpan package applications, passive modification will lower the oxygen level to the design value within 24 to 72 hours. This rate of modification will be satisfactory when produce will subsequently be stored for four weeks longer. However, there are applications where passive modification is not satisfactory.

For very low respiring produce that cannot be packed at high density, the volume of headspace surrounding the produce is too large to be modified rapidly by the produce respiration. Whole heads of lettuce is a good example of this situation. They typically take 5 to 7 days to modify passively, by which time the quality of the lettuce has already deteriorated in the partially modified atmosphere.

For highly perishable produce, the loss of 1 day in beneficial MA due to passive modification can represent a substantial proportion of available postharvest life. These produce require full MA from the moment of packing.

In these types of cases, active modification is required. Generally this is carried out on vacuum gas flushing machines. The unsealed package is placed between the machine jaws. Initially a moderate vacuum is pulled on the package to remove the majority of the air. The package is then flushed with a suitable gas mix so that the desired MA is created inside the package (gas mix and residual air combine to deliver the design MA). The package is then heat sealed before the machine jaws release the package.

Please note that the above information is supplied in good faith, but does not represent a guarantee of performance of LifeSpan in every application. Due to the variability inherent in all natural products, including fresh produce, there will be situations where the above information is not accurate.