

New protective packaging for conservation of Cacao Beans



Conservation issues

The conventional supply chain of cocoa beans poses a range of challenges to preserve the quality of the beans, from country of origin to processing. The main problems are related to:

- i. Moisture - cocoa beans are hygroscopic, and actively absorb moisture from the air
- ii. Moulds and Mycotoxins – aggravated by the hygroscopic nature of the beans
- iii. Insect infestations – due to increasing resistance of insects to chemical fumigants (and the risk of residues of higher dosages) and poor organic fumigation practices in country of origin
- iv. Rancidity due to exposure to high temperatures and rancidity due to oxidation.
- v. Odor sensitivity - beans easily pick up stray flavors
- vi. Self-heating and post fermentation – may occur under suitable ambient conditions when stored/transported in bulk; high temperature (> 25°C), high relative humidity and lack of oxygen supply, due to high oil content

How can these challenges be tackled with the vQm system?

Probably the most comprehensive study on cacao beans, packed in a high barrier film under vacuum, was carried out by the University of Gent, in Belgium. They conducted a 6-month duration trial under extreme climate conditions (30°C and 80% RH). The conclusions on the most salient aspects, include:

i) Water Transmission

“The barrier properties of the packaging film for water vapour is very high, in these extreme climate conditions, water vapour could transport, although slowly, through the packaging film. The critical limit of 0.6 for water activity of cacao beans was not reached. So, no mould development because of storage is to be expected.”

The average moisture content rose in 6 months from 5.88 to 6.45%, whereas the average water activity rose from 0.42 to 0.51. Both values are well below the levels that are considered critical, i.e. 7.13% and 0.6. Moreover, the samples taken from the surface of the package should no significant difference from the samples taken from the middle of the packaging.

ii) **Acidity**

The study measured both the Ph and the titratable acidity (TA).

"The storage of the cacao beans in the vacuum packages and at the extreme climate conditions had no influence on the Ph and consequently, taste and flavor properties of the beans."

"The TA value was not influenced by storage period or by the extreme climate conditions in which the cacao beans were stored for 6 months. Consequently, taste and flavor properties of the beans are not changed during storage."

The average Ph at the start of the trial was the same as after 6 months, namely 5.51.

iii) **Gas concentration (oxygen barriers)**

"The barrier properties of the packaging film are strong enough to prevent an increase of O₂ inside the packages. No accumulation of CO₂ occurred because the beans were dry. The gas concentration of the headspace inside the vacuum packages stayed stable during the storage of 6 months in the extreme climate conditions (30°C and 80% RH)."

iv) **Oxidation**

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Peroxidation (PO) showed big variations between the different samples. Conclusion:

"Oxydation of the fat in cacao beans started from month 6."

v) **Free fatty acids (FFA) and visual quality**

"For the FFA value of the cacao beans no increasing or decreasing trend could be established during the storage experiment."

"No systematic trend (increase or decrease) in the different aspects of visual quality of the cacao beans could be detected during the 6 months of storage in the Vacuum Packaging System, stored in extreme climate conditions (30°C and 80% RH)."

“Even in the most extreme climate conditions, the vQm system protects cacao beans for quality degradation.”

The combination of the vQm valve, sealed inside a vacuum-proof, high-barrier liner, along with the vQm vacuum unit allows you to:

- **Vacuum pack** your cacao beans on pallet size: in a FIBC with vacuum-liner or smaller bags inside a wrapping liner
- Create **modified atmosphere (MAP), anoxic conditions**: by connecting an external nitrogen (or CO₂) supply, the vQm unit can be easily programmed for multiple cycles of vacuum followed by injection of nitrogen. By doing so, an increased nitrogen concentration can be achieved with every cycle, reducing the residual oxygen concentration inside the packaging. By doing so an anoxic environment can be created that effectively minimizes the oxidation/rancidity. When the vQm protocol “MAP vacuum” is selected, the packaging remains under vacuum, while the protocol “MAP no vacuum” will leave the packaging at (ambient) pressure once the last cycle of gas injection has been completed.



For what food applications the vQm used in general?

- The high barrier properties of the film that is used for the liner, in combination with the hermetic closure, allows you to **maintain the moisture content** of your product during the complete supply chain, from the moment of packaging. Minimize external influences on you product due to high humidity, condensation or direct water contact. If packed under vacuum, no condensation will occur on the inside of the packaging.
- By creating MAP conditions of extreme low oxygen or high CO2 concentration or by maintaining vacuum over an extended period of time, **all insects in all life stages can be eradicated**. Most quick and easy is high CO2, if the product can endure these conditions. Otherwise low-oxygen in combination with vacuum is the most applied alternative. Since the packaging is hermetic, **no re-infestation** can occur as long as it remains intact.
- Often, the quality of products is negatively affected by oxidation. By reducing the number of oxygen molecules in the packaging, this **oxidation can be minimized**. Oxidation of (lipid) fats and oils in e.g. nuts, powders, seed or brown rice is known as **rancidity**. Oxidation is also causing **decolorization** of products, e.g. dried chilies, spices or herbs.
- **Preservation of taste and aroma's**. Aroma (or smell or odor) is the sensation perceived when volatile compounds are sniffed through the nose and directly impact on the perceived taste. These volatile compounds can best be preserved in hermetic, anoxic or vacuum conditions. Products that can benefit from are e.g. dried spices, dried herbs and tea.
- Other additional benefits could be e.g. **reduction of breakage** (nuts), as the product is fixated under vacuum, **volume reduction** (fluffy powders, tea, chilies etc), **reduced temperature fluctuations** during the supply chain (under vacuum: temperature transfer is inhibited; particularly useful for e.g. green coffee when shipped in containers with big temp fluctuations inside the container (day/sun vs night).

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