Protecting integrity of Tobacco

VQM PACKAGING

PACKAGING TOBACCO UNDER VACUUM: from chemical treatment to long-term & natural protection?

Pending Patent Application No. 61/549,549

- Protection of moisture loss & water damage
- Preventive against aflatoxin growth
- Protective against re-infestation by insects
- Avoiding of discoloration
- Costs reduction
- Higher loading capacity
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1. Introduction

vQm Packaging started as a spin-off of b-Cat BV the Netherlands. b-Cat BV is specialized in low-oxygen applications that were developed in cooperation with the world’s leading company in controlled atmosphere technology for storage of fruits, namely Van Amerongen CA Technology BV. Under the brand b-Cat, alternative applications of controlled atmosphere technology were developed, including natural fumigation of food commodities and cultural heritage objects to treat against infestations.

As member of the CORESTA, Subgroup on Pest and Sanitation management in stored Tobacco, b-Cat demonstrated that this natural fumigation (based on controlled atmosphere) is also effective in tobacco and combat the “SUPER” (or cigarette) beetle. After more than 2 years of real-seize testing, the workgroup has determined the proper parameters for the tobacco industry to ensure 100% mortality, when applying controlled atmosphere technology. The new CORESTA guidelines to apply this new fumigation method are expected to be issued shortly.

Even though the treatments of commodities under controlled atmosphere has proven to be effective, it remains a one-time treatments. The risk of re-infestations remains, particularly for commodities like tobacco that are often processed or consumed long after the initial treatment and stored in large volumes or bulk. Hence, b-Cat started to look for a solution to protect commodities after treatment. It was soon clear that the ultimate protection against external influences and to best preserve the quality of the commodity is vacuum packaging. Up to packaging of 25 kg, vacuum packaging is common. For large volumes however, only expensive, complicated systems were available on the market, and not cost-effective for most applications. Under vQm packaging BV, we have developed a unique, simple product that allows to package large volumes under vacuum for most dry products.

Cigarette Beetle Control

Cigarette beetle (Lasioderma serricorne)…. once you’ve seen the first one, the others will follow soon! Cigarette beetles are the major pest of post harvest tobacco in leaf and in all finished products like cigars, cigarettes, and chewing tobacco. You definitely need to have an effective tool to get rid of them in order to avoid the spread out of infestations in the supply chain. Effective treatments reduce the risk of infestation in factories and warehouses, and lead to a reduction of customer complaints.

![Cigarette Beetle Image](image-url)
2. The urgency of alternative & sustainable insect control

Insect control in stored tobacco has mainly relied on the use of fumigation and contact pesticides applied as space or surface sprays within structures (not directly on the tobacco). Increasing concerns over the use of toxic compounds, linked to health and environmental hazards, as well as the ineffectiveness of fumigations below 16°C (61°F), but also the development of phosphine resistant populations, have fuelled the sense of urgency to find alternative control methods.

As noted in the introduction, it meanwhile has been proven that controlled atmosphere technology is a good alternative solution for fumigation: most suitable for any type of tobacco and the required mortality levels can be achieved. Yet, treatments with controlled atmosphere remain single time treatments. After treatment, the tobacco is again exposed to a high risk of re-infestation.

Over the last years, vQm Packaging has done various trials and real-seize tests on various forms of tobacco. Also, the system was presented in CORESTA meetings, including in its Pest Management subgroup.

*In our view, vacuum packaging, alongside (non-chemical) controlled atmosphere treatments, provide a unique opportunity for the tobacco industry to ban dangerous gasses and chemicals. As a result, the full tobacco chain can become environmental friendly and green.*

Besides eliminating the use of chemicals, the vacuum packaging can improve health and safety conditions for laborers significantly. It is well known that in 80% of the countries where the chemical treatments are being performed, the working conditions and the high standards which are prescribed, are not adhered to. As a result, large numbers of laborers are exposed to great health risk because of the use of the chemical treatments.

Whereas transit fumigations are still common, there is an increasing number of countries that are restricting in-transit fumigation. These countries require “gas-free declarations” and container measurements, in order to protect the workers who unload the containers. In the EU for example, the gas concentrations that are allowed for a “gas-free declaration” are extremely low.

*Figure 1:*
Fumigations still occur without proper protection
3. **Costs savings**

The acceptance of the vacuum system will not only depend on quality and environmental advantages, but also on its cost, or better on the cost saved. To obtain a proper understanding of the cost and the cost savings it is important to consider the implication in the full chain. Not only for the tobacco dealer, but also for the end user.

**Fumigation cost**

Tobacco is not treated once, but multiple times, depending where it is coming from, how long it is stored, under what kind of conditions. On average, 4 or 5 treatments before final processing is normal.

Not only do these treatments itself cost money, but also the delays in the harbors, the extra rent of the chassis and containers, needs to be taken into account. Also there is the risk of un-expected blocking of shipments. Even when the sales company has complied with the requirements of the purchaser, they are never sure that a shipment is free of insects upon arrival. As a results, the sales company is often still confronted with fines, and extra costs for a re-fumigation at the receiving end.

An additional, common problem is that an estimated 90% of the fumigations is not done in accordance with the CORESTA guidelines. Given the circumstances under which these fumigations need to be done and the (in general) low prices for the treatments, it is in practice also very difficult to meet the requirements and/or verify whether requirements are met. Practical reality is that treatments are done for more for the purpose of obtaining the required certification.

The actual costs that result from the above reality, depend on a number of factors:

- The destination of the tobacco: cold or tropical climates
- How often is the tobacco treated with chemicals and what are the costs
- Is it possible to treat with chemicals or does the commodity need to be treated with Controlled Atmosphere or freezing
- Does the treatment take place by own staff or by a contractor
- What fines are applied for non-compliance at the receiving end
- Staff time required to make reports and process the grounding fines
- Extra costs for longer rental of container
- Transportation costs to the fumigation location, plus rent of the fumigation area
- Cost of the logistical delays for the buyer
- Finally: do PH3 treatments actually help, or is the resistance of the insect too high?
The use of phosphine gas is also increasingly restricted. In the EU, treatments in winter periods can only be done in specially designed facilities, approved by local authorities and inspections agencies. In summer periods, containers need to be placed in special fumigation areas, resulting in extra cost for rental, transport handlings, custom documents, rent of chassis etc. Also outside the EU regulations are becoming stricter.

**Processing cost**
Another important cost is the fact that at present the leaf processing plants often have to shut down for around 3 months per year, since green tobacco has to be processed within a given period. When packed under vacuum, this period can be extended, allowing the factories to run all-year round. Thus effectively increasing its processing capacity with 25%.

**Quality preservation**
Under vacuum, the oxidation and discoloring of the tobacco is avoided. Hence, also the chances of downgrading the grade of the tobacco is significantly decreased.
Moreover, under vacuum, the humidity content of the tobacco remains stable, avoiding mould growth and tobacco to go to waste.

**Packaging, transport & storage cost**
The tests that vQm did, showed that under vacuum much more oriental tobacco can be packed in a C48 carton. Normally 140 kg of oriental tobacco was pressed into a C48, but with the vQm liners 175 kg were packed, still leaving almost 10 cm of empty space inside the box. As a result, it may well be possible to pack around 40% more in one carton. The savings that can be achieved as a result, will depend on the type tobacco and loading capacity that the C48 allows.
More tobacco packed in a C48, results in a similar percentage of savings in packaging cost, transport cost, storage cost and handling.

All of the above cost benefits can be well quantified based on actual, average figures of partners in the tobacco industry.
4. Pros and cons of vacuum packaging

4.1. Advantages

With vQm packaging the most important parameters can be controlled, for optimum protection and preservation of tobacco:

- **Killing all life stages of insects**
  The leaf of the packed tobacco is still “alive”. Even a light form of vacuum, the remaining oxygen content will further reduce. The respiration process of the tobacco will consume the rest of the oxygen inside. As a result, any insects at any life stage that may be inside will be killed. This is not a quick process; depending on temperature and moisture content it can take up to over 30 days. But in general such “treatment period” is available after packaging the product: while being in stock and/or while being shipped out. Before it arrives at the purchaser’s port of destination, the period is mostly more than 30 days.

- **No re-infestation**
  Because the products are packed under vacuum, insects are unable to detect the product. They are not attracted and therefore the products will be kept clean during the whole logistic chain, from the moment of packaging up until opening the bag.

- **Partial Oxygen pressure**
  During packaging, the partial air pressure can be reduced up to 5% of its normal value. Partial oxygen pressure is therefore reduced to approximately 1%. At this low oxygen level, aerobic microorganism such as fungus are stopped, product oxidation is reduced.

- **Relative humidity**
  The moisture inside the bag will be kept stable during storage, passage of humidity through the 7 layer foil are drastically reduced by the water vapour barrier.

- **Effective prevention of water damage** (e.g. floods, sprinkler, container leakages etc)

- **Temperature**
  The stability range of the product is increased and allows greater variations in external temperatures. In addition, convection heat transfer no longer takes place in the bag which reduces inner variations in temperature.

- **Other Tobacco related product**
  Beside the tobacco leaf also tests already have performed with cut rag. For some customers who already using this and started the testing they have changed from shipments by air to overseas. Without having a knowledge of the logistics everybody can see the benefits of this in the costs savings.
In short, packing tobacco under vacuum could lead to the following advantages:

1. No re-infestation with cigarette beetle or tobacco moth
2. Stable moisture/humidity level of the tobacco
3. Avoid discoloring
4. Stop growth of moulds
5. A fully clean and environmental safe application
6. Reduction of human health hazards
7. Significant volume reduction (important for storage and transport)
8. Applicable to green leaves: allows leaf processing plants to remain in production all year round
9. Improvement of the sustainability image of the industry (liners are recyclable)

4.2. Disadvantages

The main disadvantage of using vacuum packaging is the use of a foil. Most companies have taken years to ban the use of inner liners in their C48 boxes. Main reason is the such foils, while discharging the boxes, can contaminate the tobacco with foil particles. Such particles should obviously never get their way into the finished products. Also within CORESTA, an active lobby intends to get rid of the foils as a means of packaging.

Other disadvantages of introducing vacuum packaging is the increase in packaging cost, and the need to adapt the entry of the production line where C48 cartons are discharged.

Disadvantages in brief:
- Foil may enter processing lines (NTRM)
- Higher packing costs
- Adaptation of production line where the C48 is opened/discharged

The concern of foil as NTRM, has been addressed by making the foil easily traceable for regular laser sorting equipment used in the tobacco industry. In contrast to the standard foils, vQm uses a high grade 7-layer foil with color tracer.
With the Belgium company Best Sorting, vQm had its film (with tracer) tested for traceability by laser detection. As shown below, the foil composition and the light blue color, makes the foil very easy to detect.

Moreover, because the foil has a high puncture and mechanical stress resistance it is very difficult to tear. As a result, the chances of small pieces of foil to enter the production is small. In addition, it is possible to use a vacuum zipper, which makes it more easy to open the liner to discharge the carton or to take samples. In that case, no cutting with sharp objects is needed.
### 4.3. Comparison overview

<table>
<thead>
<tr>
<th>Description</th>
<th>Traditional</th>
<th>vQm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective treatment against insects in all life stages</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Protection against re-infestation</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Stops the growth of moulds</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Prevention of color fading</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Stabilization of moisture content</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Reduction possible for transportation - loading capacity</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Protection against water damage (sprinkler - container leaking)</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Non Tobacco Related Material (NTRM)</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Usefull for all Tobacco related products</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>
5. Other tobacco related trails and applications

The vQm system is not only good in the relation of the leave but can be used for many other applications in the Tobacco industry, a few alternative uses that have been tested include:

- Packaging of the tobacco waste
- Packaging of stamps
- Packaging of sample
- Packaging of cut-rag

![Image showing packaging of tobacco with text: The development of Aflatoxin under vacuum conditions is halted.]

Trails with infested tobacco packed under vacuum, shows 100% mortality results. Important to note that no insects penetrated the foil. Even when tobacco samples packed in vacuum were put in a container full of insects, no insects penetrated the foil and tobacco was not affected. After 12 months the tobacco remained under vacuum.
Blend Components turn back to their original shape, after being packed under vacuum. Upon release of the vacuum, the cell tissues fill up with atmospheric air and return to their original shape.

A reaction of formal CORESTA board members, presented with the vQm packaging for tobacco, reacted enthusiastically:

“We tried for many years to ban the use of foils in the tobacco industry, but this solution definitely will introduce it again; a perfect solution for many problems!”
6. vQm Packaging

vQm Packaging has developed and tested its vacuum system for a variety of applications and products. Materials have been thoroughly tested, including many real-seize trails, particularly in the food industry.

The strengths of vQm can be summarized as follows:

- **fully tested vacuum system available** (technology, foil, valves and accessories);
  Apart from the technology and valves, a major challenge is to find the appropriate foil composition. Key parameters for the foil quality include strength, flexibility, puncture resistance, oxygen barrier, humidity barrier and cost. That the foil meets the quality requirements for the tobacco industry we have clearly demonstrated during the previous trails in the Tobacco Industry. All materials (foils and valves) are already been certified by FDA, and other relevant international standards. In addition, important to note is that the foils are 100% recyclable, including the valve. As such, the bags can have a commercial value after use.

- **In-house expertise and R&D**
  Allowing vQm to quickly respond to special requirements from clients. E.g. during the trails, it became clear that speed of vacuuming one C48 carton should be quicker, i.e. max. 30 seconds to fit exactly in the processes lines. As a result, the vacuum head (connecting with the valve) and the vacuum technology has been adjusted to meet this requirement. In addition, the vacuum unit is being modified for more easy integration in the production line of a tobacco processing facility.

- **Full service organization**
  vQm, along with its parent company, b-Cat, has its own service organization and a rapidly expanding, international network of suppliers and distributors. Since all technology and know-how is in-house, vQm can quickly respond to service its clients and distributors.
7. Conclusion

Tobacco remains one of the most valuable, dried, processed commodities in the world. As a result, it is of utmost importance to protect the commodity during manufacturing, storage and transport from negative external influence, in particular from infestations, water damage (moulds/fungi) and degrading of the Tobacco.

This not only applies for leaf tobacco (from farm to end-user) but also for side products (unfinished products), such as cut-rag. By agreement throughout the tobacco industry, and often as a result of national legislation, the “magic bullet” commonly used in the industry against insect infestations – fumigation – is not available after the first processing stages. The still unfinished “cut rag” dried chopped tobacco leaves – most sensitive to infestations – is shipped around the world and often subjected to heavy infestations, although it is already beyond the simplest curative method of fumigation.

Root of the problem is the increasing global resistance of the tobacco beetle against traditional fumigants like PH3. The unprofessional handling of fumigations makes that the resistance of the beetle against chemical fumigants will continue to increase quickly.

The serious consequences of these increasing chemical fumigations, and human health hazards, often not talked about in public, but they are a direct consequence of the root problem. The associated cost are not known, but some leading companies in the industry estimate the financial damage is exceed $250 million in 2010.

The vQm system can solve many problems of the tobacco industry and will set the standard for the industry over the coming years.