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Carbon Appraisal®
of the different methods used for closing still wines

SUMMARY - 21 June 2007

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Study Aim

The study is aimed at preparing a comparative appraisal of greenhouse-gas emissions from a number of methods of closing still wine according to the Carbon Appraisal® method. The functional unit is a complete closure system, encompassing the closure itself and the bottleneck arrangement.

The methods compared are:

- natural cork closure fitted with a PVC or aluminium/PE composite cap
- the DIAM closure produced by Oeneo Bouchage fitted with a PVC or composite cap: the DIAM closure is a composite closure made from ground cork processed by the DIAMANT process (purification by the DIAMANT supercritical CO_2 process)
- the aluminium screwcap 'S-Cap' closure produced by Oeneo Bouchage, combining the two functions in a single product.

	Natural cork	**DIAM**	**Aluminum capsule**
Functional unit	1 closure + 1 capsule	1 closure + 1 capsule	1 capsule
Description of stopper	Cylinder of natural cork	Cylinder of composite cork (cork & food-safe seal adhesive)	Alu capsule with a PE/tin
Dimension mm	L 44 * D 24	L 44 * D 24	L 60 * D 30
Stopper mass	4.0 g	5.0 g	4.92 g
Description of cap (without head)	Composite alu/LDPE/Alu (0.95 g) or extruded PVC (0.80 g) skirt		-
Total mass of functional unit	4.80 or 4.95 g	5.80 or 5.95 g	4.92 g

Methodology

The Carbon Appraisal® method enables a quantitative appraisal of greenhouse gases generated by the physical processes required for a human activity or organisation when clear parameters can be assigned.

The method takes account of all stages of activity or, in the case of a product, all the stages of its lifecycle from manufacture of primary materials to use of the product and the end of its useful life.

The method encompasses the following two methodological approaches - these will have a bearing on the results emerging from this study:

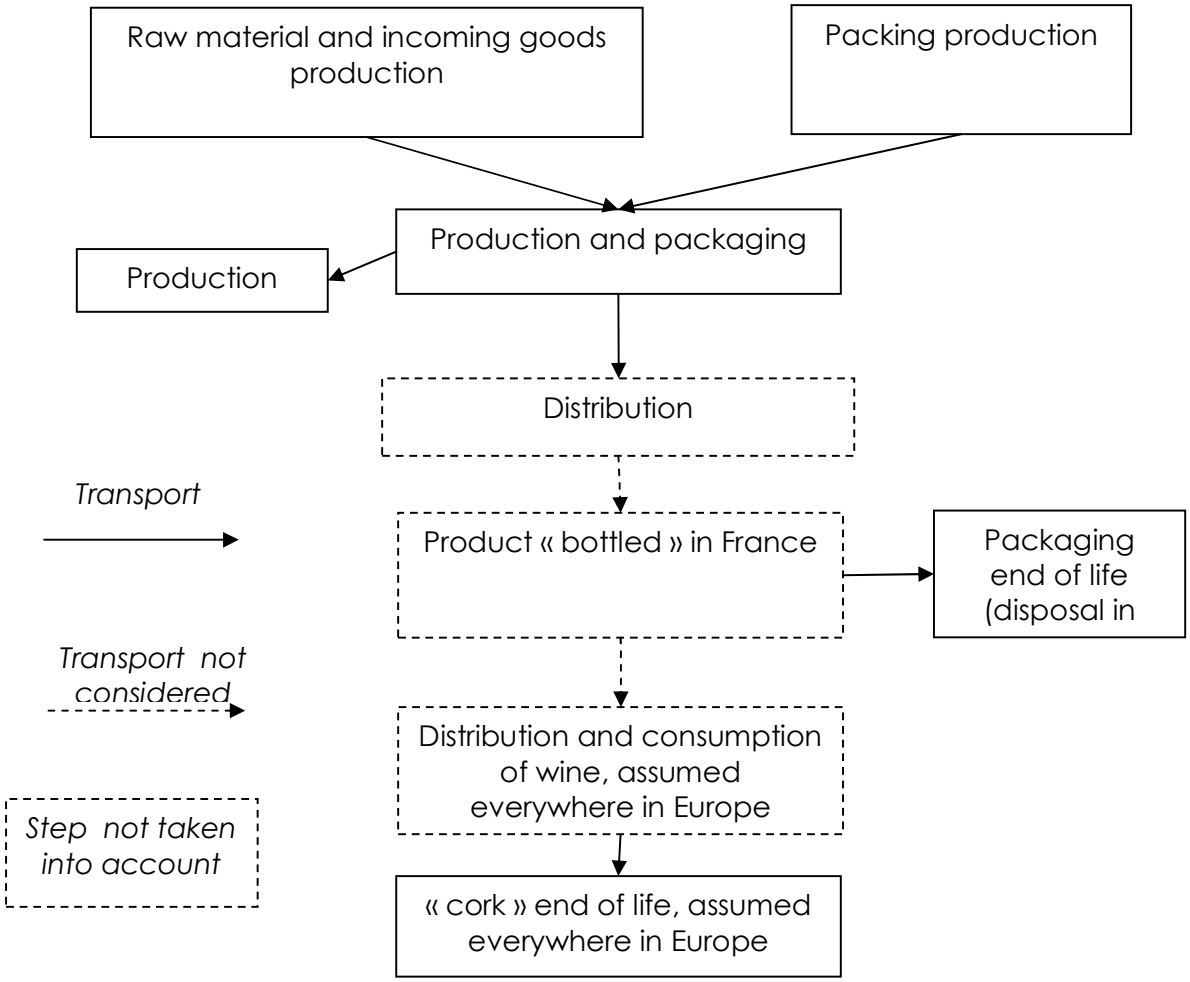
Biomass consideration:

As the Carbon Appraisal® method is basically intended for industrialized countries where there is no deforestation it does not take into account organic CO_2 emissions from burning biomass (wood, waste, etc). Indeed, the latter are counterbalanced by an annual growth in forestation. This is the case for cork production for example, with the material being renewed on the tree every 10 to 15 years. In contrast, if the way the cork is treated at the end of its useful life leads to carbon storage (for example disposal without degradation), the carbon is therefore subtracted from the atmosphere and will be recorded as negative.

Recycling consideration:

Savings in materials and energy associated with recycling (in the case of aluminium) depend on the 'stock method': recycling is taken into consideration at the time an incoming material is produced, by assigning this material 'a greenhouse-gas content' which accurately reflects the energy used in producing the material (unlike the 'avoided impacts method' which takes account of the saving made at the time wastes are processed).

Scope of the Comparative Method and Data Source



The following assumptions are made so that equivalent systems can be compared:

- Locating raw materials and production sites according to actual production criteria.
- Electricity production: European 'mean mix'.
- Distribution on the French market from an equivalence point on the territory (near the border).
- Hence the closures used by French companies and the packaging is handled as waste according to the French mean.
- 'Closed' bottles are sold throughout Europe, and at the end of its useful life the closure is handled according to the European mean.

Description of Systems Studied

Stages	PVC or composite capsule	Natural cork	DIAM	Aluminium S-Cap
Production of main primary materials	PVC or Aluminum, LDPE, Lacquer/glue	Cork (Sp/Portugal), Peroxide, Paraffin	Cork (Sp/Port) CO2, active C, Glue/microspheres, Peroxide, Paraffin	Aluminium (Germany), Lacquer
Production of packaging	LDPE/HDPE bags and boxes			
Places of manufacture	France	Preparation, processing and finishing in Extremadura, Spain	Cork processing & moulding in Extremadura (Spain) Finishing in Ceret (France)	Capsule production in Slovenia, finishing in Ceret (France)
Product manufacture	Electrical and heat energy consumed in production (electricity produced according to the European mean)			
Main items of energy consumption	Processing primary materials (extrusion or gluing, lacquering, printing)	Cork boiling, Production of stopper (cutting/extruding/milling)	Production of ground cork (crushing) Ground cork processed by the DIAMANT process (s'critical CO2) Stopper moulding and finishing	Processing of primary materials (lacquering, printing)
Main waste products	-	(Cork waste is reused by other cork sectors)	Earth/cork dust mix	Lacquered alu trimmings
Transport to distributors	-	Distribution out of Perpignan	Distribution out of Ceret	Distribution out of Nice
End of life of packaging	French mean (French wines)			
End of life of stopper	European mean (consumption throughout Europe)			

Cork primary material

The cork is produced in Mediterranean cork-oak plantations, mainly in the south-west of the Iberian peninsula (Portugal, Extremadura, Andalusia). Cultivating cork oaks is a special forestry activity ensuring both economic activity and maintenance of a woodland environment rich in biodiversity and adapted to the circumstances of the regions concerned (prevention of fire in particular).

The main use of cork is the production of stoppers, natural or composite, at competitive prices; cork that cannot be used for stoppers or waste from processing stoppers is used by other sectors in the form of a composite (for insulation, for example).

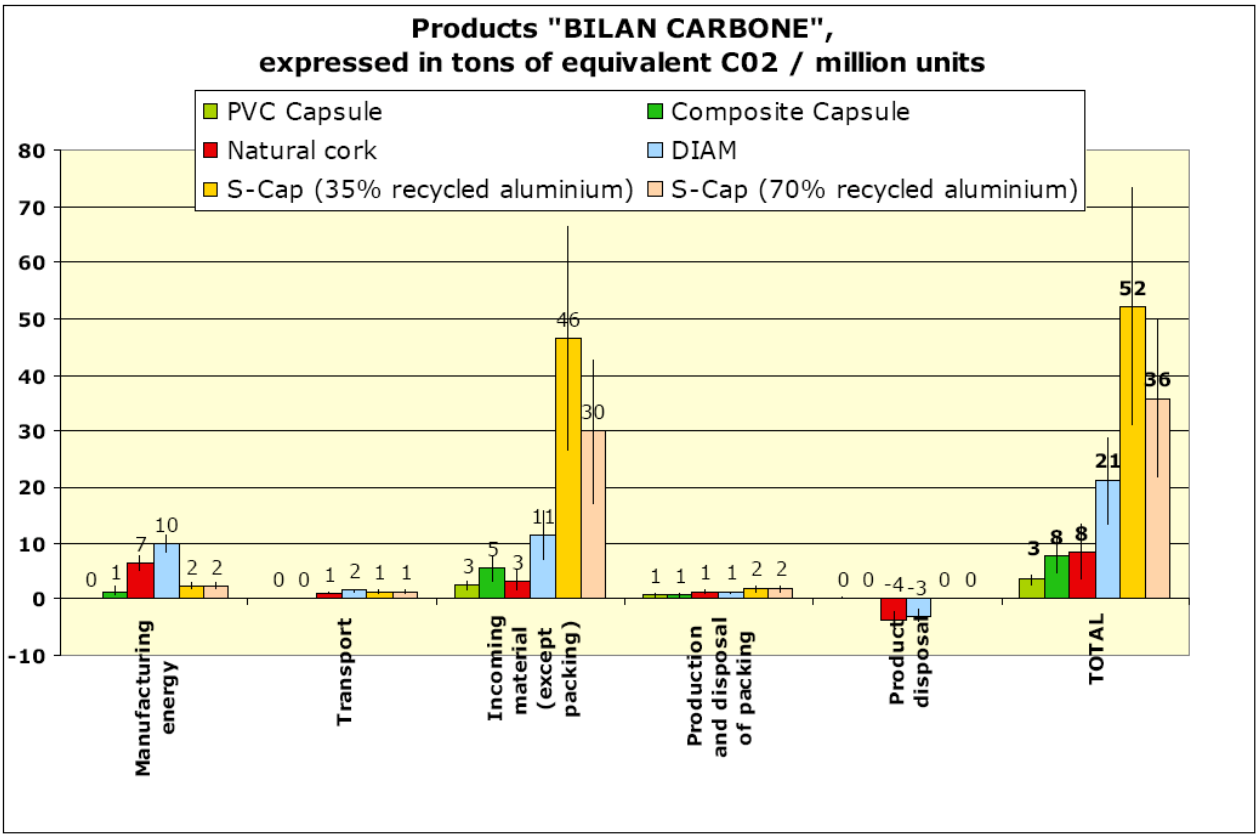
Today the cork-oak plantations of the Iberian Peninsula show a different aspect: ageing (poor regeneration) of formerly productive plantations due to a lack of maintenance and pressure from other activities (agriculture, herding); creation of new settlements on abandoned agricultural land.

The outlet with strong added value provided by the cork industry means that existing cork-oak plantations can be maintained and new settlements established - hence significant carbon storage can be maintained.

It has not been possible to make a 'quantitative' connection between the carbon stored in the oak forests and the functional unit of the bottle closure because too many assumptions would have to be made. However, the following qualitative correlation may be borne in mind: the production of cork closures, whilst maintaining the oak forests, supports carbon storage as well as biodiversity associated with the local ecosystem and specific industrial and agricultural activities.

Carbon Appraisal® of the various products studied

The various products studied have the following carbon footprint*:



* Vertical bars: the error margins are significant for all products owing to uncertainties in emissions from incoming materials but also in the data. The DIAM appraisal, made on the basis of the Oeneo Bouchage Carbon Appraisal, logically shows a smaller margin of error.

The carbon profile for the various systems studied differs somewhat:

- The natural cork closure profile is quite simple and depends mainly on energy used in processing, with the cork primary material showing a low emission figure. Carbon storage in waste cork strongly influences the appraisal.

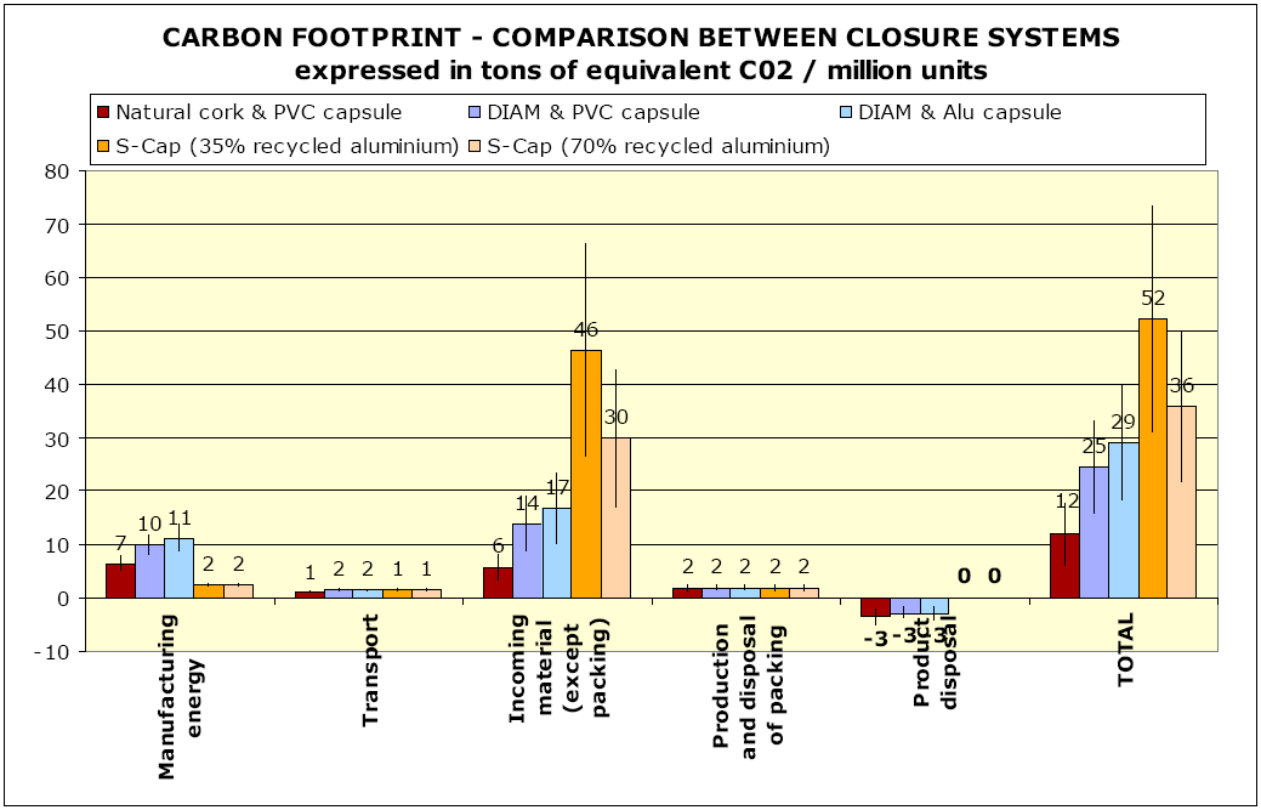
- The DIAM profile is influenced half by energy consumption in the cork-preparation and closure production stages, and half by the incoming non-cork materials (food-safe glue enabling ground cork to be compressed, active carbon of the DIAMANT process).

- The profile of screwcap closures depends on the greenhouse-gas content of the primary material aluminium, that is, the amount of recycled aluminium in it.

- Likewise, the profile of caps depends on the materials deployed, with the aluminium used in the composite material leading to a higher figure for this system.

Carbon Appraisal® of the various closure types

An analysis of the functional units shows the following carbon footprints:



The type of cap selected influences significantly the ranking for closure systems. In the case of DIAM, a PVC cap increases the figure for the closure alone by 16%, whereas a composite cap increases it by more than a third.

The basic system involving natural cork shows a better outcome, but no account is taken here of problems due to TCA and other documented issues.

In terms of its organoleptic quality, the performance of the DIAM closure shows a generally lower figure than the aluminium screwcap closure, the difference deriving from the amount of recycled aluminium used in producing the capsule.

The figure for the capsule can only be improved by supplying aluminium with a higher content of recycled primary [and] secondary materials, but this is limited in Europe by the amount of aluminium collected and recycled.

On the other hand, the DIAM solution has the advantage of being able to improve its figure for energy consumption within Oeneo Bouchage - this representing 40% of emissions from the DIAM & PVC cap solution and 34% of emissions from the DIAM & composite cap solution.

Contribution of closures to the carbon footprint of wine

The table below compares the figures for closure systems with a simplified appraisal for glass bottles, another element essential to the packaging of wine.

	Unit mass (g)	t eq CO2/million	kg eq CO2/Tonne
Natural stopper & PVC cap	4.8	11.9	2 490
DIAM & PCV cap	5.8	24.7	4 253
DIAM & aluminium cap	5.95	28.9	4 863
S-Cap (35% recycled)	4.92	52.3	10 633
S-Cap (70% recycled)	4.92	35.9	7 291
Glass bottle*	400	183.3*	458*

* The manufacture of the glass bottle and end of life only are taken into account (data: Carbon Appraisal method)

It is noted that unit production for closures has a lower impact than bottle packaging, but is more significant when the volume of products is taken into account.

Closures, although of small significance for the wine bottle as a whole (approx. 1% of total packaging and less than 0.05% of the weight of the full bottle), is not negligible in terms of its contribution to the carbon footprint of the product wine.

Conclusion

The study of the various closure systems produced by Oeneo Bouchage reveals that the production of this item essential to the packaging of wine has a non-trivial carbon impact compared with other items of packaging.

The carbon profile of the different closure types studied differs somewhat, influenced by the primary materials used (S-Cap, caps), by the processing energy (natural cork) and by both materials together (DIAM).

Despite the significant margins of error inherent in the method, which are intended to be a practical tool highlighting orders of magnitude, the impact of the system consisting of the DIAMANT closure and composite cap is less than the screwcap closure, based on current rates of aluminium recycling (from 35% on average across the whole European market to 70% for the soft-packaging sector) and equivalent performance levels (safety vis-à-vis cork taint and appearance).

In terms of potential development, the capsule is limited by progress in the market for recycled aluminium and hence by the collection and recylcing of aluminium products.

On the other hand, Oeneo Bouchage can improve the impact of DIAM production by endeavouring to reduce emissions from energy consumption (reduction of consumption and switch to energy with a low carbon content), with a potential reduction of carbon emissions in the order of 40%.

Moreover, using an entirely synthetic cap improves the impact of the overall closure system.

Lastly, favouring cork as a primary material helps to maintain cork-oak plantations, which act as carbon sinks. Although no precise figures have been put on this sink in the context of this study, and have therefore not been incorporated quantitatively into the footprint, this is a positive which should be taken into account in further studies of this nature.

In conclusion, two aspects should be emphasized in our opinion:

- The cork-based DIAM closure reveals a carbon footprint that is more favourable in quantitative and qualitative terms than the S-Cap screwcap closure, subject to current aluminium recycling rates in Europe.

- The use of low-carbon energy in the production of the DIAM closure will make a sustained impact on the difference of DIAM with regard to the screwcap closure system.