Aquamark stopper carbon footprint

Amorim Cork, S.A.

Executive summary

June 2021

Building a better working world

Disclaimer

EY carbon footprint analysis follows a life-cycle approach based on ISO Standard 14040 and is based on Amorim Cork data and business assumptions. The results presented are not third-party verified.

Agenda

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2. Carbon footprint

Cradle-to-gate

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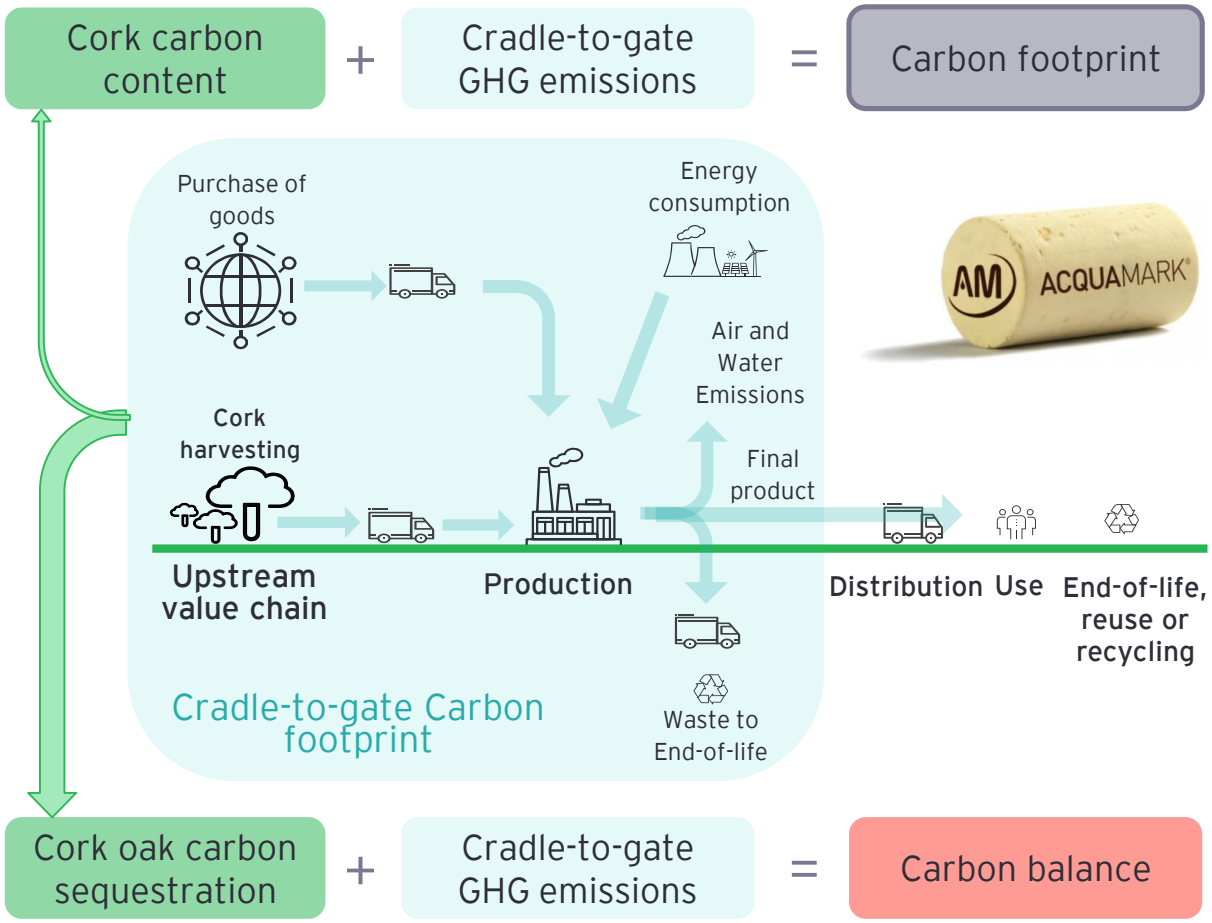
Expedition to UK

3. Carbon balance

Scenario analysis with carbon sequestration at the forest stage

4. Conclusions



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About the study

About the study

Context

- Corticeira Amorim is the largest world producer of cork products, championing the sector since 1870. The company has a portfolio of products with applications in multiple industries, such as wine, construction, flooring, aeronautical, automobile, footwear, among others. The company has implemented an integrated production process that ensures that no cork is wasted.
- Cork is an ecological and sustainable material 100% natural, renewable, recyclable and reusable.
- Amorim Cork, the cork stoppers business unit of Corticeira Amorim, is the world leader in production and supply of cork stoppers with its own distribution network, which places the company in a position to provide stoppers for any wine segment, anywhere in the world.
- Amorim Cork can offer a large range of high-quality solutions for the wine industry, from natural cork stoppers, to technical cork stoppers and sparkling and spirits wines stoppers.
- The **main purpose** of this study is to quantify the potential greenhouse gas emissions generated by the Aquamark stopper produced by Amorim Cork, through a life cycle approach.
- Aquamark is a cork stopper that has a superior sealing capacity and wine preservation. It is a natural cork stopper covered with a water-based coating, which enhances its sealing potential, by binding the cork extracts to the stopper's surfaces.

Product characteristics	Average dimensions
Size (mm x mm)	45 mm x 24 mm
Weight (g)*	4,1 ± 0,59
Components (%)	91,1% cork 0,9% customization products

About the study

Methodology

- The study analyses the carbon footprint of the Aquamark stopper, through a life cycle analysis (LCA) approach.
- **Guidelines**: The study was based on ISO 14040/44 series of standards, complemented with the guidelines from the International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance
- **Approach**: *cradle-to-gate (*from raw material extraction to the finished product at the factory gate)
- **Life cycle stages assessed**: forest management activities, cork treatment, including cork transport from the supplier, natural cork bodies production, Aquamark stopper production, finishing and packaging
  - For comparison with previous studies, the stage of expedition of the final product to a bottling site (assumed to be in UK, as a common destination) is also assessed, although not included under a cradle-to-gate approach, and disclosed as additional information.
- **Functional unit***:* 1000 stoppers
- **Modelling software and database***:* SimaPro 9.1 with ecoinvent 3.5 database
- **Method**: Midpoint characterization factors recommended by the International Reference Life Cycle Data System (ILCD). The potential climate change impacts of each stage were estimated selecting the impact category Climate Change from the ILCD method.

Impact category	Unit	Description	Reference
Climate Change (CC)	kg CO_{2eq}	Global Warming Potential (GWP) calculating the radiative forcing over a 100-year time.	Fourth Assessment Report of the Intergovernmental Panel for Climate Change (IPCC) 2007

About the study

Methodology (cont.)

- **Data collection procedure**

- **Biogenic emissions and CO_{2eq} removals due carbon content in the reference flow are also considered, with the following assumptions:**
  - All cork raw materials that enter the system were considered to have a similar amount of carbon stored. The calculation of CO_2 uptake is based on the atomic weights of carbon (12) and carbon dioxide (44), as well as the carbon fraction (dry basis) of 55% and a moisture fraction of 6%[1].
  - Given the purpose of the assessment, emissions from biomass energy production are considered neutral, due to the assumption that the CO_2 that is being released in the incineration process (biogenic CO_2) was captured in the previous product stage 1 - forest management and cork harvesting (uptake), as so, it is no more than a short term delayed emission, resulting in a net neutral balance of CO_2 emissions [2,3].

[1]Dias, A.C., Arroja, L., 2014. A model for estimating carbon accumulation in cork products. Forest Systems 2014 23(2): 236-246
[2]Demertzi, M., Paulo, J.A., Arroja, L., Dias, A.C., 2016. A carbon footprint simulation model for the cork oak sector. Science of the Total Environment 566-567 (2016) 499-511
[3]Rives, J., Fernandez-Rodriguez, I., Rieradevall, J., Gabarrel, X, 2013. Integrated environmental analysis of the main cork products in southern Europe (Catalonia - Spain). Journal of Cleaner Production 51 (2013) 289-298

About the study

Methodology (cont.)

- **Additional scenario analysis of the potential carbon sequestration at the forest stage**
  - A scenario analysis was performed, given past studies[3,4,5], where it is assumed that carbon sequestration of the cork oak forest can indirectly be attributed to cork products was simulated, as the cork transformation industry contribute to the exploitation and maintenance of the cork oak forest.
  - The analysis compares the GHG emissions of the studied cradle-to-gate system to the cork oak forest carbon uptake, considering the cork weight in the functional unit. The resulting carbon balance is presented as an additional environmental information, as should not be confused with the carbon footprint analysis, where GHG emissions and biogenic stored carbon by cork are addressed.
  - Carbon stored in the product was excluded for this scenario to avoid double counting. Allocation of CO_2 uptake to the cork extracted from the cork oak stands follows the same premises of allocating environmental impacts in a previous study[6].
  - In this study, a **weight-based perspective for carbon sequestration at the forest stage was considered**: All CO_2 uptake by the cork oak forest is allocated to extracted cork, as cork production is the main economic activity of cork oak forest, considering the weight of cork present in the functional unit of the final product.
  - The analyzed scenarios consider carbon sequestration in well-managed cork oak forests, with a high tree coverage and good soil and climate conditions, to have an average CO_2 uptake of 11 t CO_2/ha[7] , reaching a maximum of 14,7 t CO_2/ha. Translating[8] these values in function of cork extraction, there is a CO_2 uptake of 55 t CO_2/t of cork extracted, reaching up to 73 t CO_2/t of cork extracted.

[4]PwC/Ecobilan, 2008. Evaluation of the environmental impacts of cork stoppers versus aluminium and plastic closures. Corticeira Amorim, Santa Maria de Lamas http://www.amorimcork.com/media/cms_page_media/228/Amorim_LCA_Final_Report.pdf
[5] EY, 2019. Environmental footprint of natural cork stoppers. Corticeira Amorim, Santa Maria de Lamas.
[6]Dias, A.C., Rives, J.S., González-García, S., Demertzi, M., Gabarrel, X., Arroja, L., 2014. Analysis of raw cork production in Portugal and Catalonia using life cycle assessment. International Journal of Life Cycle Assessment (2014) 19:1985–2000
[7]Figures considered in the "The value of cork oak montado ecosystem services" (EY, 2019c). Average ecosystem CO_2 uptake (11 t CO2/ha) considers wet and dry years in well managed forests, with a maximum of 14,7 t CO2/ha registered in optimal climatic conditions (Costa-e-Silva et al., 2015).
[8]Conversion of forest ecosystem uptake per tonne of extracted cork considers the total cork oak occupation area in Portugal (719 937 ha) (ICNF, 2019) and an average value of cork production (145 000 t cork) based on a nine-year series (2003-2011) (APCOR, 2011).

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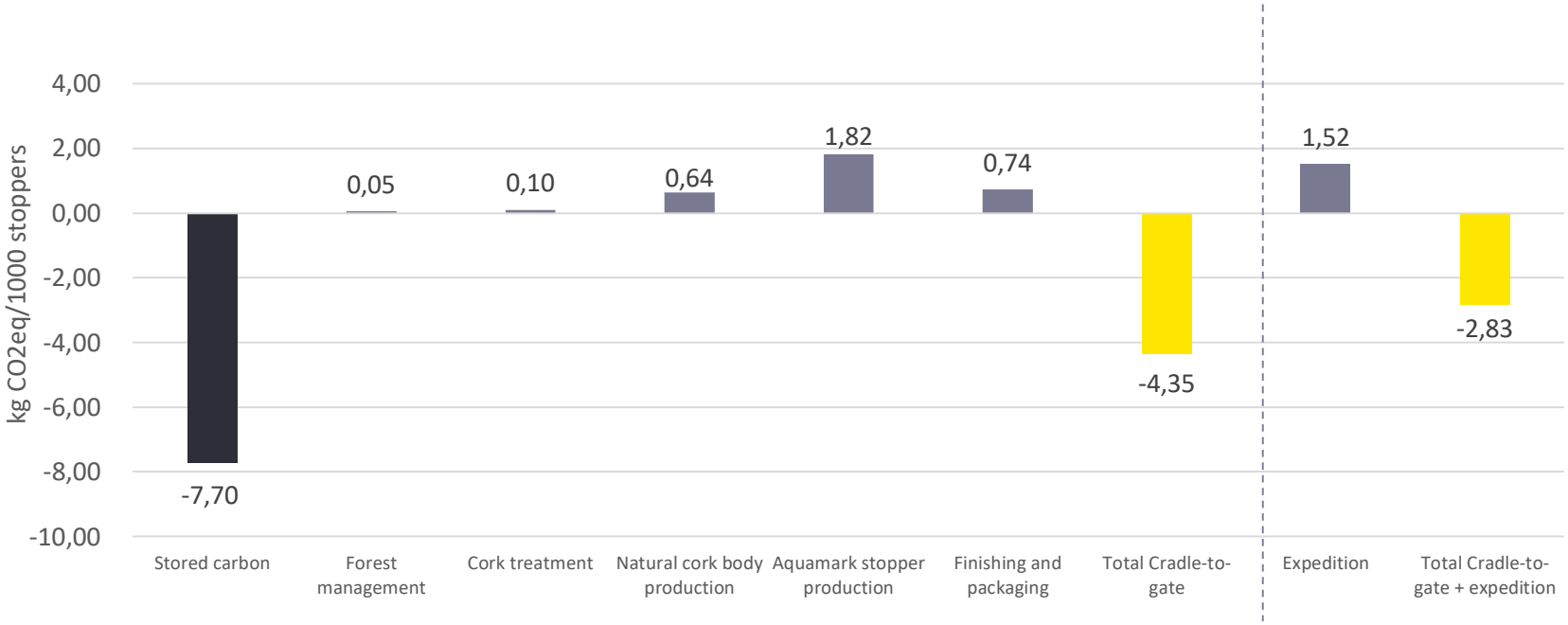
Carbon footprint

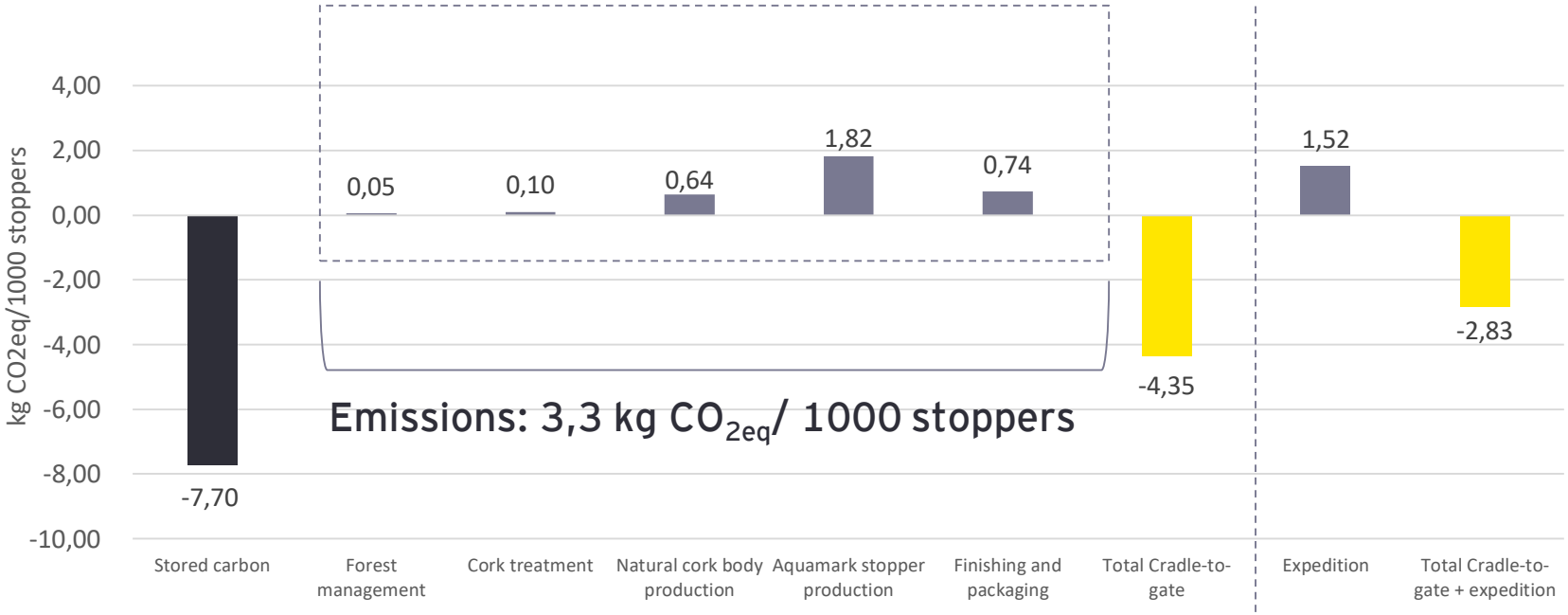
Carbon footprint: results



Aquamark stopper carbon footprint:

- Cradle to gate: **-4,4** kg CO_{2eq} /1000 stoppers
- Cradle to gate with expedition to UK: **-2,8** kg CO_{2eq} /1000 stoppers

Carbon footprint: results



54% emissions associated with processes occurring in the Aquamark stopper production stage

- Most upstream value chain activities carbon impacts (e.g. production and purchase of chemical products) are reflected in this stage
- Higher energy consumption (indirect impacts of electricity production)

3

Carbon balance

Carbon balance: results

Scenario analysis with carbon sequestration in the cork oak montado

For the maximum weight Aquamark stopper when considering carbon sequestration in the cork oak* montado:

There is a **forest storage up to**:

- 339

kg CO_2/1000 stoppers

Therefore, the **carbon balance reaches up to**

-335

kg CO_{2eq}/1000 stoppers

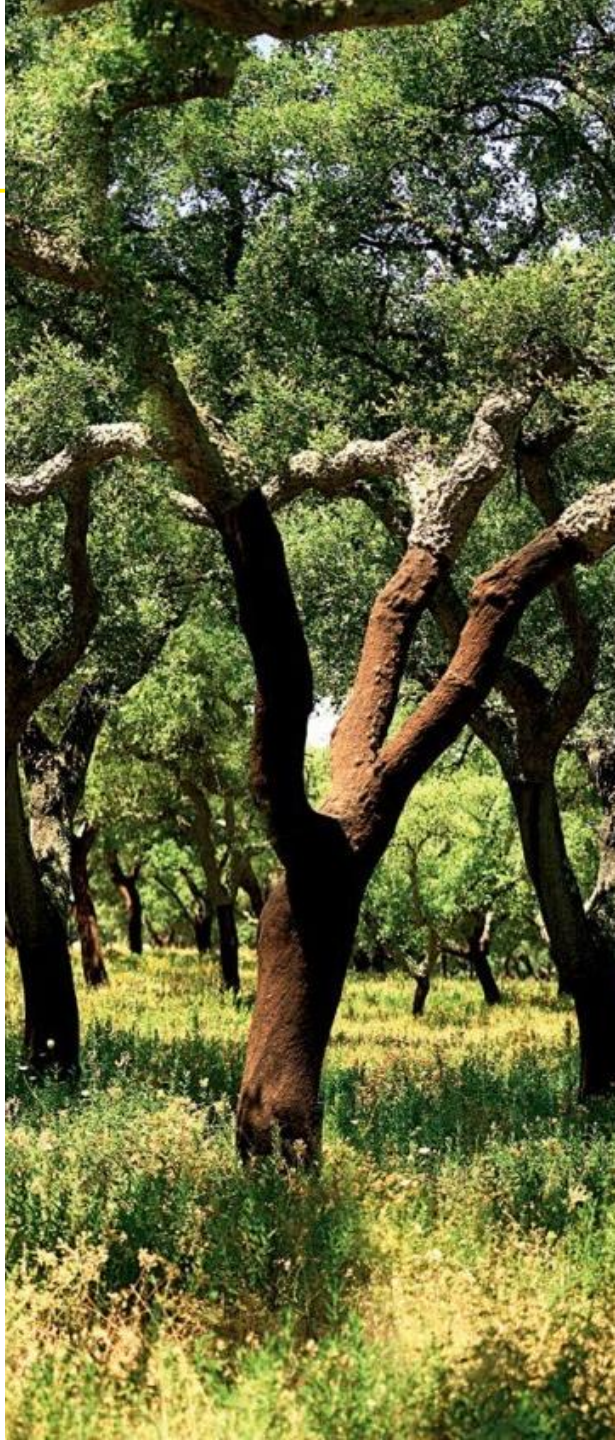
* scenario analysis based on well-managed cork oak montado

- 73 t CO_2/t cork

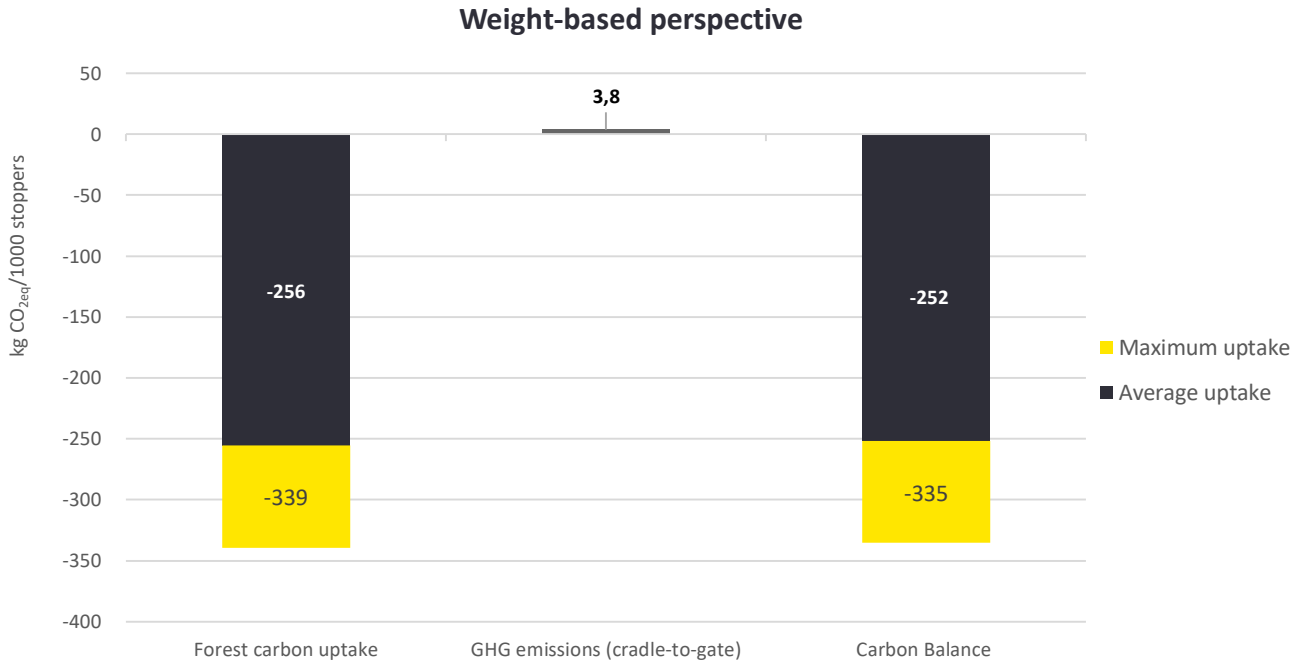
Maximum ecosystem CO_2 uptake registered (14,7 tCO_2/ha) (Costa-e-Silva et al., 2015).

with the average ecosystem CO_2 uptake being - 55 t CO_2/t cork, considering wet and dry years in well managed forests (11 t CO_2/ha).[9]

[9] figures used in "The value of cork oak montado ecosystem services, EY 2019"



Carbon balance: maximum weight stopper



Aquamark stopper **carbon balance** reaches up to:

-335 kg CO_{2eq}/1000 stoppers

considering maximum ecosystem CO_2 uptake registered in a well managed cork oak montado **-73 t CO_2/t cork**

4 Conclusions

Conclusions

Carbon footprint

- Overall results for year 2018 show that, under a cradle-to-gate approach, the highest climate change impacts are associated with the processes stages where the consumption of energy and the use of chemical products is higher, as a result, the impact of Aquamark stopper production stage and the finishing and packaging stage together account for 76% of total cradle-to-gate GHG emissions.

- Relevant sources of overall impacts are related to the manufacture of purchased chemical products (42% of total GHG emissions), such as binding agents, used in the clogging processes, and electricity consumption (31% of total GHG emissions), occurring in all the product system's stages.

- Total emissions account for an overall climate change impact of 3,3 kg CO_{2eq} per 1000 stoppers. Considering the carbon stored in Aquamark stopper (7,7 kgCO_2/1000 stoppers), the carbon footprint of the product is -4,4 kgCO_{2eq} per 1000 stoppers, under a cradle-to-gate approach.

Carbon sequestration of the cork oak forest

- Considering a scenario analysis, where the carbon sequestration of the cork oak forest can indirectly be attributed to cork products, based on well-managed cork oak forests, a forest carbon uptake up to -339 kg CO_2 per 1000 stoppers can be observed.

- Considering both the forest carbon uptake and the GHG emissions of maximum weight Aquamark stopper production (3,8 kg CO_{2eq}/1000 stoppers), there is a carbon balance up to -335 kg CO_{2eq} per 1000 stoppers. This balance illustrates the differentiating factor between cork and other products.

- As the cork oak tree retains carbon for over 100 years, regardless of cork harvesting, cork exploitation supports the maintenance of the ecosystem, thus having a positive contribution to global climate regulation.

Technical sheet

Technical sheet

Title "Carbon footprint of Aquamark stopper: Executive summary"

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