Ahlstrom is committed to contributing to a more sustainable future. Our approach is based on thinking that we make products with purpose at the same time minimizing the environmental impacts of both our operations and the products. Our ambition is to assess the environmental performance of our products with the Life Cycle Assessment (LCA) methodology and for product development, to use EcoDesign and Green Chemistry principles. Environmental Product Declaration helps us to communicate our LCA results and environmental performances with a standardized method.
Methodology

Main hypotheses

Ahlstrom NatureMold™ Classic and Ahlstrom NatureMold™ Shape Lock

Product description

Ahlstrom’s NatureMold™ molding materials are an alternative to molds or trays made out of aluminum.

Ahlstrom NatureMold™ Classic is made out of our genuine vegetable parchment, and can be as thick as 150 g/m².

Ahlstrom NatureMold™ Shape Lock is made out of an inner layer of parchment, a middle layer of kraft paper and an outer layer of biopolymer polylactic acid (PLA) nonwoven deriving from plant starch. In both products, our parchment ensures greaseproofness, easy release and high temperature resistance as well as wet strength.

For the Shape Lock, the PLA nonwoven layer, when activated, allows the shape of the mold to be locked even in a humid environment by acting like a fixing agent.

This molding material is manufactured at the Saint Séverin (France) and Bousbècque (France) plants for parchment and Chirnside (United Kingdom) plant for PLA nonwoven. These plants are ISO 14001, ISO 9001 as well as Chain-of-Custody certified.

It means that NatureMold™ Classic and Shape Lock are available with FSC™ or PEFC™ certifications, ensuring that wood pulp comes from responsible sources.

Product composition

<table>
<thead>
<tr>
<th>Product Composition</th>
<th>Small Classic Mold (1.61 g per piece)</th>
<th>Small Shape Lock Mold (1.92 g per piece)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Genuine Vegetable Parchment</strong></td>
<td>100%</td>
<td>41%</td>
</tr>
<tr>
<td><strong>Kraft + Glue</strong></td>
<td>41%</td>
<td>41%</td>
</tr>
<tr>
<td><strong>PLA nonwoven (Polylactic Acid)</strong></td>
<td>18%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Commitment towards sustainable development

Ahlstrom decided to conduct a Life Cycle Assessment (LCA) study on Genuine Vegetable Parchment (GVP)-based molds and aluminum molds to determine the impacts of those products on the environment.

With this study, we aim at identifying main contributors to mold environmental impacts and make a comparison of Ahlstrom GVP-based materials with aluminum materials as regards to their environmental credentials.

Functional unit

The impacts have been calculated according to the following reference:

“to produce one round shaped mold to be used as a cooking and presentation mold for food products”

The LCA results presented in this EPD correspond to small size molds with a 110 mm diameter and a 20 mm height.

For this study, two different markets are distinguished:

- The frozen food market where the Ahlstrom NatureMold™ Classic mold is compared to the aluminum mold
- The fresh and semi-fresh food market where the Ahlstrom NatureMold™ Shape Lock mold is compared to the aluminum mold

Main hypotheses

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>End-of-life scenario</strong></td>
<td>European household waste treatment for non-recyclable materials I.e. landfill disposal at 68% and incineration at 32%[15]</td>
</tr>
<tr>
<td><strong>Calculation biogenic CO₂</strong></td>
<td>No credits associated with temporary storage, delayed emissions and substitution of CO₂ were allocated to paper and PLA products due to the short lifespan of these products</td>
</tr>
</tbody>
</table>

Aluminum mold

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recycling methodology</strong></td>
<td>Substitution method defined by the ILCD Handbook was applied as the most recent and recognized one at the European level, it is also recommended for all types of products</td>
</tr>
<tr>
<td><strong>Recycled content</strong></td>
<td>10% was chosen as the recycled content of aluminum mold products based on available information for wrought aluminum alloy used in packaging applications[16]</td>
</tr>
<tr>
<td><strong>Recycling rate</strong></td>
<td>According to the European Aluminum Foil Association for aluminum molds and semi-rigid aluminum containers, Ahlstrom considered 50% as recycling rate for aluminum molds after use[17]</td>
</tr>
</tbody>
</table>

---

[1] Large size molds with a 247 mm diameter and a 23 mm height were also considered in this LCA study. The comparison between GVP-based molds and aluminum molds presents similar trends in case of large size molds and small size molds even if with large size molds, the results are slightly more favorable to GVP-based molds.


Impacts for a small Classic mold

Inventory indicators

<table>
<thead>
<tr>
<th>Water consumption (net):</th>
<th>Non-renewable energy:</th>
<th>Renewable resources:</th>
<th>End of life indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 L of water, over the life cycle of the Classic mold</td>
<td>0.20 MJ of non-renewable energy, over the life cycle</td>
<td>Renewable resources content: 99%</td>
<td>Compostability: The total structure is biodegradable and compostable under controlled conditions according to EN 13432, ASTM D 6868 and ISO 17088 Standards</td>
</tr>
</tbody>
</table>

Impact indicators (5)

You’ll find a description of each impact indicator at the back of this document. See paragraph “Glossary”.

Comparison of the Classic mold with the aluminum mold on impact indicators (6)

<table>
<thead>
<tr>
<th>Classic mold, 91 g/m²</th>
<th>Aluminum mold 137 g/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Warming</td>
<td>62.2 [%]</td>
</tr>
<tr>
<td>Abiotic depletion</td>
<td>10.5 [g CO₂-eq]</td>
</tr>
<tr>
<td>Acidification</td>
<td>48.0 [%]</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>100 [%]</td>
</tr>
<tr>
<td>Photochemical Oxidation</td>
<td>30.4 [%]</td>
</tr>
</tbody>
</table>

(6) Comparison with the aluminum mold is based on the same mold sizes, life cycle steps and functional unit as the GVP-based molds including the recycling of aluminum material after use, data from Ecoinvent database. For small size aluminum molds, a 49 µm thickness (137 gsm, 2.42 g per piece) was considered based on specification of actual products available in the market.

(5) In the full LCA study, the environmental impacts Freshwater ecotoxicity and Ozone layer depletion were also included. In order to simplify the communication, these impacts are not reported in the present EPD even if the results obtained were in favor to GVP-based molds.
Impacts for a small Shape Lock mold

Inventory indicators

Water consumption (net):

0.16 L of water, over the life cycle of the Shape Lock mold

Value for the aluminum mold: 0.07 L of water, over the life cycle

Non-renewable energy:

0.21 MJ of non-renewable energy, over the life cycle of the Shape Lock mold

Value for the aluminum mold: 0.24 MJ of non-renewable energy, over the life cycle

Renewable resources:

Renewable resources content: 94%

Value for the aluminum mold: 0%

Impact indicators (5)

<table>
<thead>
<tr>
<th>Material</th>
<th>Global Warming</th>
<th>Abiotic depletion</th>
<th>Acidification</th>
<th>Eutrophication</th>
<th>Photochemical Oxidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>39.8 [%]</td>
<td>44.1 [%]</td>
<td>56.0 [%]</td>
<td>67.9 [%]</td>
<td>46.4 [%]</td>
</tr>
<tr>
<td></td>
<td>4.52 [g CO₂-eq]</td>
<td>0.034 [g Sb-eq]</td>
<td>0.0228 [g SO₂-eq]</td>
<td>0.0070 [g PO₄³⁻-eq]</td>
<td>0.000901 [g C₂H₄-eq]</td>
</tr>
<tr>
<td>Production</td>
<td>44.4 [%]</td>
<td>50.6 [%]</td>
<td>37.6 [%]</td>
<td>17.1 [%]</td>
<td>35.7 [%]</td>
</tr>
<tr>
<td></td>
<td>5.04 [g CO₂-eq]</td>
<td>0.039 [g Sb-eq]</td>
<td>0.0153 [g SO₂-eq]</td>
<td>0.0018 [g PO₄³⁻-eq]</td>
<td>0.000694 [g C₂H₄-eq]</td>
</tr>
<tr>
<td>Transport</td>
<td>4.8 [%]</td>
<td>4.4 [%]</td>
<td>4.6 [%]</td>
<td>3.5 [%]</td>
<td>2.0 [%]</td>
</tr>
<tr>
<td></td>
<td>0.54 [g CO₂-eq]</td>
<td>0.003 [g Sb-eq]</td>
<td>0.0019 [g SO₂-eq]</td>
<td>0.0004 [g PO₄³⁻-eq]</td>
<td>0.000045 [g C₂H₄-eq]</td>
</tr>
<tr>
<td>End of Life</td>
<td>11.0 [%]</td>
<td>1.0 [%]</td>
<td>1.8 [%]</td>
<td>11.5 [%]</td>
<td>15.9 [%]</td>
</tr>
<tr>
<td></td>
<td>1.25 [g CO₂-eq]</td>
<td>0.001 [g Sb-eq]</td>
<td>0.0008 [g SO₂-eq]</td>
<td>0.0012 [g PO₄³⁻-eq]</td>
<td>0.000309 [g C₂H₄-eq]</td>
</tr>
<tr>
<td>Total</td>
<td>11.35 [g CO₂-eq]</td>
<td>0.077 [g Sb-eq]</td>
<td>0.0407 [g SO₂-eq]</td>
<td>0.0104 [g PO₄³⁻-eq]</td>
<td>0.001943 [g C₂H₄-eq]</td>
</tr>
</tbody>
</table>

Comparison of the Shape Lock mold with the aluminum mold on impact indicators (6)

<table>
<thead>
<tr>
<th>Material</th>
<th>Global Warming</th>
<th>Abiotic depletion</th>
<th>Acidification</th>
<th>Eutrophication</th>
<th>Photochemical Oxidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape Lock mold, 108 g/m²</td>
<td>67.2 [%]</td>
<td>75.7 [%]</td>
<td>53.8 [%]</td>
<td>100 [%]</td>
<td>33.7 [%]</td>
</tr>
<tr>
<td></td>
<td>11.35 [g CO₂-eq]</td>
<td>0.077 [g Sb-eq]</td>
<td>0.0407 [g SO₂-eq]</td>
<td>0.0014 [g PO₄³⁻-eq]</td>
<td>0.001943 [g C₂H₄-eq]</td>
</tr>
<tr>
<td>Aluminum mold, 137 g/m²</td>
<td>100 [%]</td>
<td>100 [%]</td>
<td>100 [%]</td>
<td>100 [%]</td>
<td>100 [%]</td>
</tr>
<tr>
<td></td>
<td>16.9 [g CO₂-eq]</td>
<td>0.102 [g Sb-eq]</td>
<td>0.0758 [g SO₂-eq]</td>
<td>0.0065 [g PO₄³⁻-eq]</td>
<td>0.00576 [g C₂H₄-eq]</td>
</tr>
</tbody>
</table>

(5) In the full LCA study, the environmental impacts Freshwater ecotoxicity and Ozone layer depletion were also included. In order to simplify the communication, these impacts are not reported in the present EPD even if the results obtained were in favor to GVP-based molds.

(6) Comparison with the aluminum mold is based on the same mold sizes, life cycle steps and functional unit as the GVP-based molds including the recycling of aluminum material after use, data from Ecoinvent database. For small size aluminum molds, a 49 µm thickness (137 gsm, 2.42 g per piece) was considered based on specification of actual products available in the market.
Environmental Product Declaration

Product lifecycle

Key categories of the life cycle:

- **Materials**: forest management, corn cultivation, extraction of non-renewable resources and production of raw materials
- **Production**: Ahlstrom factory operations and mold production
- **Transport**: necessary transport between each step (Dotted transport lines are out of system boundaries)
- **End of life**: waste collection, landfilling and incineration of the parchment after use

Small Classic mold product lifecycle:

- Forests
- Non renewable inputs
- Pulp production
- End of life treatments
- Waste collection
- Mold production
- Mold filling-up, cooking, distribution and usage

Small Shape Lock mold product lifecycle:

- Forests
- Non renewable inputs
- Pulp production
- End of life treatments
- Waste collection
- Mold production
- Mold filling-up, cooking, distribution and usage

Conclusion

- GVP-based molds generally have lower environmental impacts than aluminum molds when considering their whole life cycle.
- Results are not in favor of the GVP-based molds for the water consumption and eutrophication environmental categories due to the water used in the pulp and paper making processes. It is however worth noticing that water is consumed in geographic areas not stressed by the availability of fresh water. In addition, substances known to contribute to eutrophication problems (nitrogen, phosphorus and COD) are monitored closely in pulp and Ahlstrom plants.
- On the positive side, the Classic and Shape Lock molds are made from more than 94% renewable resources from sustainably managed forests and the Classic mold has been certified biodegradable and compostable.

Additionally, GVP-based molds have a 35% smaller carbon footprint than the aluminum molds on average.

In conclusion, whether we compare the environmental impacts of molds for frozen food applications (Classic); or molds for fresh and semi-fresh food applications (Shape Lock); the GVP-based molds present a better environmental performance than aluminum molds on the majority of the life cycle indicators included in this study.
Ahlstrom is a high performance fiber-based materials company, partnering with leading businesses around the world to help them stay ahead. We aim to grow with a product offering for clean and healthy environment. Our materials are used in everyday applications such as filters, medical fabrics, life science and diagnostics, wallcoverings and food packaging.

More information about Ahlstrom’s initiatives to promote greater environmental responsibility and encouraging the development of environmentally friendly technologies is available on www.ahlstrom.com/sustainability.

LCA verification
LCA was conducted by Ahlstrom internal experts according to ISO14040/ ISO14 044 standards.
LCA was verified through a peer review conducted by EVEA in order to assess the conformity to the standards.
EPD generated with EVEA support.

References
Ahlstrom, Life Cycle Assessment study of Vegetable Parchment Molds, June 2014, Final report, LCA study conducted by Ahlstrom experts
Product Category Rules CPC class 3214 for processed paper and paperboard, International EPD, System, version 1.1, 2010-12-09.
LCA Methodology Guidelines and indicators from CML 2000, IPCC, Cumulative Energy Demand 1.07.

Glossary
GVP (Genuine Vegetable Parchment): Cellulose material with a structure between a paper and film and produced through a parchmenting process of paper.
PLA (Polyactic acid): Biopolymer deriving from plant starch.
EPD (Environmental Product Declaration): Standardised (ISO 14025/TR) and LCA based tool to communicate the environmental performance of a product or system.
LCA (Life Cycle Assessment): Compilation and assessment of inputs and outputs, as well as the potential environmental impacts of a product, or a system, during its life cycle.
Functional Unit: Quantified performance of a product system for use as a reference unit in a life cycle assessment study.
System Boundaries: Determine which unit processes are included in the LCA study.
Renewable resources: Animal or vegetal material which can replenish and offset the natural or human depletion.
Biogenic carbon: CO₂ stored by biomass during plant and emitted during decomposition or combustion.
Global warming: Release of greenhouse gas over the life cycle contributing to global warming potential, expressed as CO₂ gram equivalents. Also called carbon footprint.
Abiotic depletion: Scarcity of mineral and fossil resources, by considering the quantity of world reserves and the current level of consumption, expressed as Antimony (Sb) gram equivalents.
Acidification: Release of substances into the atmosphere leading to potential acidification of air, soil and water, expressed as SO₂ gram equivalents.
Eutrophication: expresses as PO₄³⁻ gram equivalents – the consideration of nitrogen and phosphate substances introduced into the aquatic environment. The intake of large quantities of these nutrients is responsible for algal blooms and oxygen depletion.
Photochemical Oxidation: Indicates as C₂H₄ gram equivalents – the gas emissions having an effect on the creation of photochemical ozone in the lower atmosphere (smog) under the effect of solar radiation.

More info
Report of the LCA study accessible on demand and upon a Non Disclosure Agreement Signature

Learn more:
email: food@ahlstrom.com
www.ahlstrom.com

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