EcovaMed

Life Cycle Assessment

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Recycling PVC medical tubing cuts greenhouse gas emissions by 25% compared to incineration

The **greenhouse gas emissions** of the **healthcare sector** represent **5 to 10%** of the national emissions of most countries in the world,[1] making the healthcare sector a key contributor to global warming. Since medical devices and pharmaceutical products roughly account for half of these emissions,[2] it is critical to better evaluate and reduce their carbon footprints to contribute to the overall reduction of emissions by the health sector. Ecovamed, a company specialised in Life Cycle Assessment (LCA) and carbon footprint evaluation of health products, developed a methodology to perform such evaluations in a more efficient way, facilitating high-quality results, low cost, and compliance with international standards. This methodology is well adapted to medical devices, medicines and their components, and can be performed within a cradle-to-gate or cradle-to-grave scope.

Single-use medical devices are generating important waste quantities in hospitals, which are most of the time incinerated with emission of greenhouse gases in the atmosphere. To lower the greenhouse gas emissions of the healthcare sector, **the reduction of waste quantities is a key driver**. Among all options to achieve such a reduction, the mechanical recycling of the used medical devices stands out as a cost-effective solution to hospitals, while simultaneously contributing to the reduction of their greenhouse gas emissions.

Ecovamed performed the LCA of PVC-based medical tubing in Europe by calculating its cradle-to-grave carbon footprint, based on GHG Protocol standard,[3] for two end-of-life scenarios:

- **Incineration with energy recovery** and acid flue gas treatment,
- **Recycling of medical tubing by mechanical grinding** in Belgium, with an 80% yield, and production of wall coverings with the recycled material.

The LCA was carried out using public data or primary data from manufacturers, if available, considering all greenhouse gas emissions from the extraction of raw materials to the end-of-life of PVC-based medical tubing. The production of the raw materials (including their packaging) and transport, the device packaging production and its transport, the production and sterilisation of medical tubing, the transport from the production plant to a warehouse and from the warehouse to the healthcare facilities, the use phase and the end of life have all been considered in this study, whose results are shown in Figure 1.

On a cradle-to-grave basis, **recycling** allows to **reduce by 25% the greenhouse gas emissions** of a PVC medical tubing on its full life cycle, as compared to the scenario with incineration, corresponding to **2.0 kgCO_2eq avoided per kg of tubing**.

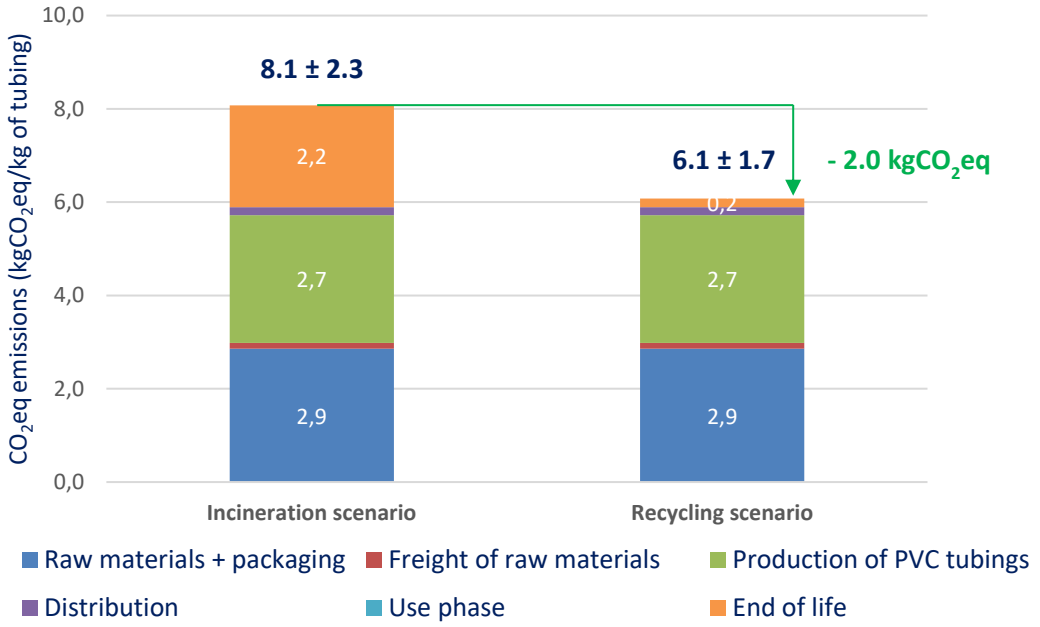

Figure 1: Cradle-to-grave carbon footprint of a medical PVC tubing for two end of life scenarios: recycling vs. incineration (in $kgCO_2eq$/kg of tubing)

6 200 tons of plasticised PVC being used each year in Europe to produce medical tubing,[4] **the annual greenhouse gas avoided emissions** if all medical tubing would be recycled are **13 165 tonsCO_2eq** emissions, which is equivalent to **7 438 back and forth flights for 1 passenger between Paris and New York** (see Figure 2).

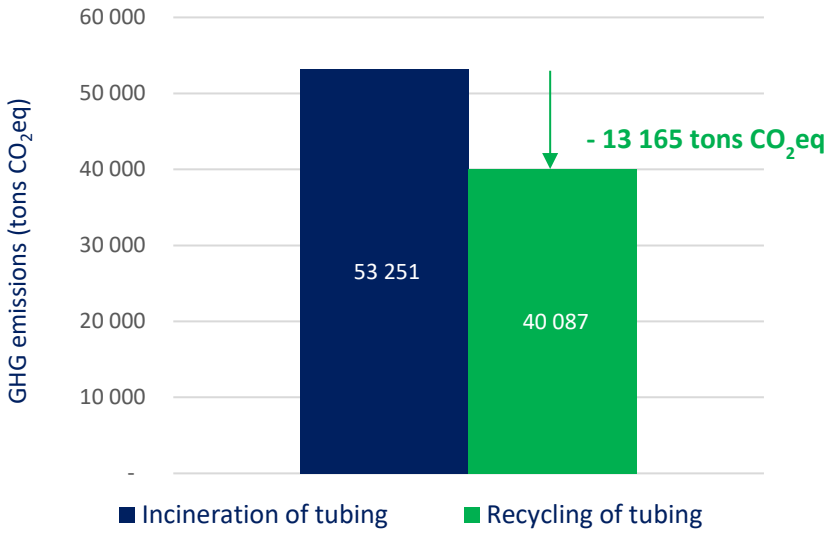

Figure 2 : *Cradle-to-grave annual greenhouse gas emissions from the PVC medical tubings used in Europe: recycling vs. incineration (in tonsCO_2eq/year)*

These LCA results highlight the main greenhouse gas emission contributors for a PVC-based medical tubing. The **raw materials for PVC tubing manufacturing** (35-47%) – particularly the **PVC** resin (19-25%) – and the **energy** for tubing production and sterilisation (24-31%) are top contributors. The **end-of life** of the medical PVC tubing is also a main source of CO_2 emissions within the incineration scenario (27%).

Additional improvements could be done to further reduce PVC-based medical device carbon footprint, such as:

- Use of a **PVC resin made from low carbon electricity and low carbon steam**, which can significantly decrease its carbon footprint,
- Use **renewable energies** for **medical tubing manufacturing, sterilisation and recycling**; sterilisation being the highest energy user in this evaluation,
- Increase the **recycling yield** (95% instead of 80%) would also allow to strongly improve the avoided greenhouse gas emissions when PVC-based medical tubings are recycled.

About Ecovamed

We are an innovative company created in 2020, with the ambition to contribute to a sustainable access to health products. By relying on an improved process**, Ecovamed allows the healthcare industry and the chemical, polymer and biotechnology industries to assess the carbon footprint and LCA of their products at a lower cost**, which is the first step before setting greenhouse gases emission reduction plans. Ecovamed is also supporting health professionals to eco-design healthcare pathways. For more information on Ecovamed, visit www.ecovamed.com or contact us at contact@ecovamed.com**.**

(1) P.-P. Pichler *et al*, 2019, Environ. Res. Lett., **14**, 064004
(2) Decarbonizing Health for Sustainable Care, Shift Project, April 2023, https://theshiftproject.org/article/decarboner-sante-rapport-2023/
(3) https://ghgprotocol.org/product-standard
(4) Europe Medical Polymer Market Report, Global Market Insights, 2021

Conflict of interest

Ecovamed provides services to the healthcare industry, including LCA and carbon footprint assessment of their products and support to reduce their greenhouse gas emissions. Ecovamed notably provides consulting services to Plastics Europe and medical device manufacturers.