

Life Cycle Assessment Applied to Antimicrobial Materials – Review of Studies

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1. Introduction

The European Union Green Deal has set the ambitious goals of (i) zero net emissions for greenhouse gases by 2050, (ii) economic growth decoupled from resources use, and (iii) no person nor place left behind (European Commission, 2020). One of the corner stone of this ambitious plan is the full implementation of the safe and sustainable by design (SSbD) framework, which is necessary to address the changes and challenges of modern society and makes the EU a step closer to the Green Deal objectives and to tackle the problem of toxicity and sustainability as early as possible.

However, lack of stakeholders' coordination, limited access to relevant data, and absence of standardised methods have thus far hampered the emergence of a comprehensive approach to SSbD. The project INSIGHT - Integrated Models for the Development and Assessment of High Impact Chemicals and Material² aims to overcome these challenges by developing an innovative framework for mechanistic impact assessment of chemicals/materials.

The INSIGHT's framework will be applied to case-studies covering different industrial segments and including antimicrobial materials (metal-oxide based UV-C-upconverters in novel coatings). The main materials used for antimicrobial coatings are graphene materials, graphene-like two-dimensional materials, polycationic hydrogel, silver nanoparticles, dendrimers, copper and its alloys, and polymer brushes. These features can be applied to a wide range of materials, including metals, plastics, textiles, and ceramics, making them suitable for diverse applications, e.g., medical, textile, and food and beverage. Despite their benefits, antimicrobial coatings can rise the potential environmental impacts of a product. As a result, environmental assessment in the form of life cycle assessments (LCA) have been conducted to understand the full extent of the potential impacts.

A literature review of the LCAs for antimicrobial materials is necessary to comprehend the data available, the method used, and how far this topic has advanced so far. Thus, the aim of this study is to provide a review of the LCAs produced for antimicrobial materials.

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² INSIGHT - Integrated Models for the Development and Assessment of High Impact Chemicals and Materials (GA No.: 101137742); Call Topic: HORIZON-CL4-2023-RESILIENCE-01-22.

2. References

European Commission (2020). The European Green Deal.
https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en