Master’s thesis proposal

Optimisation of furniture materials for fire safety and circularity

Background

Loose furnishings, such as stuffed furniture, beds, and textiles can be flammable, contribute to rapid spread of fire and produce a lot of smoke and heat when they burn. This limits the time and opportunity for evacuation and fire rescue. Regulations regarding the fire performance of interior textiles, armchairs, sofas and mattresses have been discussed nationally and internationally for many years without resulting in more stringent requirements for such products.

A possible problem with introducing more stringent fire safety requirements is that they may increase the amount of flame retardant chemicals in circulation. Flame retardants have traditionally been a common solution for improving fire protection in interior products, but some have been found to be harmful to human health and the environment. Flame retardants can also affect other furniture characteristics, such as quality, comfort and possibilities for recycling.

Fire safety and environmental considerations are important factors that are often set against each other. It is therefore important to promote the development of safe and fireproof furnishings that are environmentally friendly throughout their life cycle, and which satisfy other requirements that are usually imposed on this group of products.

Project description

The main objective of this project is to contribute to new knowledge about how fire safety associated with loose interior design can be improved through developing products that meet sustainability and circularity requirements. These new products will have comparable fire performance as flame retarded reference products but will rely on construction techniques and materials having little or no flame retardants in them. The new products will be safe while in use and will be recyclable at the end of life.

The proposed master’s thesis will focus on analyzing the environmental aspects of the new furnishings, including their materials and construction processes. The furnishings, materials, and construction techniques will be selected in coordination with other aspects of the overall project, such as fire safety considerations and regulatory trends. The steps in the thesis are as follows:

Step 1

Working with other members of the project and reference group, create a screening tool based on life cycle assessment (LCA) from cradle to furnishing manufacturer gate of the materials used in potential new furnishings, together with their reference products. Collect the necessary inventory data on the materials and any manufacturing processes that are not common to both the new and the reference products. Use the screening tool to suggest a small number of materials as candidates for further development. The final material selection decision will be taken by the project leader based on other performance metrics as well, such as fire safety, comfort, appearance, service life, etc.

Step 2

Conduct a comparative LCA from cradle to grave on the most promising new/reference product pair using the ISO 14040 and 14044 standards for guidance. This LCA can make use of the results of Step 1 for the materials and manufacturing processes but shall also include the service life and end of life of the products.
Qualification
This project is part of a larger project that includes fire testing, materials/textile development, and interactions with members of the reference group and industry. The student must be a good communicator and be able to work as part of a team. The LCA work will be done under the guidance of an experienced researcher but will require extensive data collection and careful documentation. It is recommended that the student at least be familiar with the concept of LCA and preferably be enrolled in the Environmental Systems Analysis Division.

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