



Dyes and additives for fossil-free textile chains: linking fibre production, protected cultivation of high-value products and processing

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To which design flagship did you submit your proposal?

A: Design Flagship Methodological Innovation

What are you exploring? With what objective?

The production of materials for textiles (fibres and auxiliaries like dyes) is one of the largest consumers of carbon based materials. Considerable effort has already been taken to make the sector more sustainable by using non fossil materials with an ecological footprint that is less than cotton, such as fibre hemp and linen produced as "new" crops in agriculture. In this project, we would like to make a cross-over between the transformative concepts of Vertical Farming and Circular Materials. The objective is to design a value chain, in which high-value crops grown in protected cultivation can be used in a fossil-free textile chain, re-using "waste" material of the production. The design of the system will take the possibilities for local product valorisation into account, exploring the scale at which production needs to take place.

Why is this interesting scientifically?

Vertical Farming is a novel system for crop production, which allows nearly perfect control of all environmental conditions. Combining this research area with physiological and biochemical knowledge of secondary plant metabolites allows for the design of production systems for high-value crops, that can provide compounds to be used as dyes or additives in non-fossil value chains, next to the primary production and the valorisation of the stems for textile fibres. This requires the selection of crops and varieties for these new production systems and applications, as well as the development of new processing methods for these new feedstocks. Design of circular plant production systems and the subsequent processing into products is still in its infancy, where breakthroughs can be developed and described.

How is this relevant to the materials transition?

Vertical Farming offers possibilities to produce high value products, with desired characteristics, such as controllable levels of secondary metabolites. To explore and increase the viability of this concept is to make use of material that is now wasted such as stems and other plant parts. This will open new markets and bring additional value to the Vertical Farming industry world-wide, which aims to develop high-value product-market combinations. It will reduce waste, increase the efficiency and economic viability of Vertical Farming production systems. In addition, this project is relevant to supply new tools and options for industry and growers linked to protected cultivation. The opportunities of application to a local system will be sought and evaluated.

What are the key activities or steps?

- Activity 1: workshop with researchers in the fields of cultivation of fibre crops, textile value chain, plant secondary metabolites, high-value crops in Vertical Farms, processing, waste streams and circularity.
- Activity 2: system design of production of high value crops that provide dyes for the textile value chain, including selection of compounds, carbon footprint, connection with industry for CO₂ supply, re-use of other plant parts and processing.
- Activity 3: dissemination of the system design to relevant stakeholders and the research community by presentations and (internet) news items.
- Activity 4: describing the learning journey in the design of the system with multiple disciplines within WUR and stakeholders outside WUR.

What are key deliverables?

- Deliverable 1: report describing the outcomes of the workshop (Activity 1), with the aim to develop a cross-disciplinary understanding of the system, how the different disciplines could add value, and what the consequences for other parts of the value chain are.
- Deliverable 2: Presentation of the system design of production of high value crops that provide dyes for the textile value chain to be used in acquisition of future projects.
- Deliverable 3: dissemination of the system design via presentations and (internet) news items.
- Deliverable 4: Final report describing the learning journey in the design of the system with multiple disciplines within WUR and stakeholders outside WUR

One what issues would you like to get input from others?

- Expert knowledge in one of the fields that are relevant to this topic
- Expert knowledge in setting up a systems design of new value chains
- Valorisation of a system that is a new combination of existing and proven technologies.

