SIPTex:
Svensk Innovationsplattform för Textilsortering

Titel	SIPTex Svensk Innovationsplattform för Textilsortering
Löptid	2016-06-01 till 2018-08-31
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Finansiering	Projektet finansieras av Vinnova

Svensk projektsammanfattning

SIPTex skapar en unik testmiljö för automatiserad textilsortering. Projektet bidrar till ökad resurseffektivitet och slutna textilkretslopp genom att matcha kvalitetskrav från kunder med snabb, högkvalitativ sortering.

I sin andra fas bygger SIPTex vidare på de lyckade sorteringstest som genomfördes i Steg 1 genom att hyra in och driva en sorteringsanläggning i Sverige under ett års tid. Över 800 ton material kommer sorteras i anläggningen. Efter manuell försortering av textiler för återbruk kommer all övrig textil matas in i den automatiska sorteringsanläggningen som använder visuell (VIS) och nära-infraröd spektroskopi (NIR). Ett stort antal test kommer att genomföras. Målet är att sortera textilavfallet i fraktioner som skall matcha kvalitetskrav från olika återvinnare och återvinningsmarknader, med fokus på högkvalitativ fibertill-fiber-återvinning.

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Utgående material kommer att testas med avseende på fiberinnehåll och innehåll av oönskade, potentiellt farliga kemiska ämnen. Materialens lämplighet för mekanisk återvinning kommer också att testas genom produktion och utvärdering av demonstratorer (garn och tyger).

En affärsmodell för en fullskalig (>15 000 ton) automatiserad sorteringsanläggning för textil kommer att tas fram, som bl.a. tar hänsyn till befintliga och nya marknader, trolig framtida lagstiftning, tillgängliga volymer, materialvärden, investeringskostnader och driftkostnader.

Industriella och hushållsnära insamlingssystem för textil kommer att utvärderas tillsammans med informationskampanjer för att ökad textilinsamling.

Ett brett konsortium och en aktiv aktörsdialog med materialåtervinnare och textilföretag säkerställer förankring och involvering av hela värdekedjan.

English summary

SIPTex creates a unique testing environment for automated textile sorting. The project contributes to increased resource efficiency and closing textile loops by matching customers´ quality requirements with fast and highly accurate sorting technology.

In its second phase SIPTex builds on the successful test results in Step 1 by placing and operating a rented textile sorting facility in Sweden for one year. More than 800 tons of used textiles will enter the sorting process. After manual pre-sorting for reuse, all textiles not suitable for reuse will be fed into the automated sorting using visual (VIS) and near-infrared spectroscopy (NIR) technology for a large number of tests. The objective is to sort the textile waste so that output materials from sorting match quality requirements of different recyclers and recycling markets, focusing primarily on higher quality (fiber-to-fiber) recycling processes.

Output materials from sorting will be analyzed regarding fiber composition and potential substances not wanted in the textile loop. Their suitability for mechanical recycling will be tested by producing and evaluating demonstrators (yarn and fabrics).

A business model for a large scale (>15 000 ton) automated textile sorting facility will be developed considering e.g. current and potential markets, likely implementation of policies, available input volumes, value of material streams, investments and running costs.

Industrial and close-to-home textile collection systems will be evaluated along with end user information for increased waste collection.

The wide project consortium and an active stakeholder dialogue with textile recyclers and textile producing companies will ensure involvement of the complete textile value chain.

Background and project idea

Textiles constitute some of the most resource demanding materials with rapidly increasing consumption over the last decades. In 2013, less than 20% of the 121.000 tons textiles consumed in Sweden were reused and less than 5% recycled. The Swedish EPA proposes 40% reuse and 25%

(primarily fiber-to-fiber) recycling of textiles as milestone targets by 2020. Policy measures, e.g. potential extended producer responsibility (EPR) for textiles, are being investigated.

Efficient sorting of (low quality) used textiles forms the crucial link between collection and efficient use of collected materials and, thus, an important step for closed textile loops. Already in 2013 more than 7.000 tones used textiles from Sweden were exported for sorting due to lack of domestic sorting capacities. With the proposed milestone targets, the need for efficient sorting of used textiles will increase significantly. Currently more than 30 charitable organizations and an increasing number of municipalities, municipal waste companies and waste management companies are engaged in textile collection. Creating efficient domestic sorting capacities would lower transport costs for textiles for recycling and increase profitability for these actors and, at the same time, create job opportunities and green growth for Sweden. The design of a future EPR significantly influences the conditions for a sorting facility in Sweden.

Sorting of textiles for reuse and recycling in larger scale is still carried out manually. Whereas manual sorting of textiles for reuse is necessary to match the demands of different reuse markets, efficient solutions for automated sorting of textiles for recycling are missing and called for by stakeholders in the textile value chain. In order to operate efficiently and profitably such automated solutions must be able to manage high material throughput and meet recyclers´ demands on output materials (e.g. purity, fiber types, colors etc.). The precision of manual sorting of textiles is generally not sufficient for higher quality (fiber-to-fiber) textile recycling.

The sorting trials in small scale in Step 1 indicate promising results for the use of visual (VIS) and near-infrared spectroscopy (NIR) technology to sort textiles for recycling both regarding practical sorting feasibility and quality of the output materials. The technology used showed high precision and resulted in high recovery rates indicating high market relevance.

SIPTex will rent equipment for recognition and sorting and carry out sorting of used textiles in a pilot sorting facility in Sweden during one year. Project partners will provide >800 tones used textiles to be sorted for reuse and recycling. The sorting trials will further test and optimize the technology in order to match output materials from sorting with customers´ needs and to reach efficiency in the sorting process. The sorting of textiles for recycling will use VIS and NIR techniques combined with automated sorting and handling techniques.

Output fractions from textile sorting for recycling will be analyzed in order to evaluate how well the output materials from sorting match pre-defined specifications and customers´ needs. In case specifications and needs are not met, the technology and sorting process will be adjusted accordingly. A close dialogue with relevant stakeholders before, during and after the tests will help secure efficient sorting and output fractions suitable for high-quality recycling and closed textile loops. This enables increased resource efficiency and contributes to a circular economy. Relevant stakeholders include particularly textile recyclers (buyers of output material from sorting) and textile producing companies (putting new textiles on the market and potential buyers of recycled fibers).

Objective and expected results

An industrial collection and logistic system for textile wastes will be tested and evaluated at Bromma recycling center. Additionally new concepts for close-to-home textile collection will be investigated. Two end-consumer information campaigns focusing on increased textile collection

and sustainable consumption patterns for textiles will be developed and tested in Malmö in the beginning and in the end of the project.

An operational pilot facility for advanced sorting of textiles will be operated for 12 months. Non-reusable textiles will be sorted for recycling using VIS and NIR technology. Quality of output fractions will be compared to manual sorting processes. A close dialogue with textile recyclers throughout the project will match output material from sorting match customers´ needs and secure markets for sorted materials.

Laboratory tests regarding purity and different chemical substances in the output material will be carried out. Additionally stakeholders will evaluate samples of output material. Demonstrators of yarn and fabrics will be produced and tested for mechanical properties.

A business plan for implementing a large scale automated sorting facility combined with an operational research facility will be developed in order to evaluate the profitability of the tested technology. The business plan will consider changes in legislation, e.g. potential EPR for textiles that can change the market drastically. The plan will contain costs related to collection, transport and sorting. Different output materials from sorting will be valued and their markets defined. Next steps for further development in the innovation chain of textiles will be defined and a plan for up-scaling of the pilot plant set up.

Workpackages and tasks

SIPTex Step 2 will be carried out in five interacting work packages following the value chain of textile wastes from collection to recycling and potential use in new textiles. An active stakeholder dialogue with textile producing companies, textile recyclers and authorities throughout the project will secure relevance and applicability of project results.

WP 1 Collection of textiles

Increased textile collection is necessary to secure sufficient material flows for an operational large scale automated sorting facility (result goal Step 3). The project will test and evaluate techniques for collection of textiles.

- Task 1.1 Test of industrial collection system at recycling center
- Task 1.2 Test of close-to-home collection
- Task 1.3 Communication for increased textile collection

WP 2 Sorting of textiles

Sorting for reuse (pre-sorting) will be carried out manually whereas sorting for recycling will use automated VIS and NIR technology. Input materials to sorting consist of 700 tons textiles from recycling centers and additional 100 tons pre-sorted textiles.

- Task 2.1 Set-up and initial test of technology
- Task 2.2 Planning of tests
- Task 2.3 Realization of tests

- Task 2.4 Stakeholder dialogue

WP 3 Analysis of output materials

To validate the applicability of the tested technology as well as recycling markets for the sorted textiles output material will be evaluated; both in laboratory analyzes and evaluations by stakeholders.

- Task 3.1 Laboratory tests of output materials
- Task 3.2 Stakeholders´ view on output materials
- Task 3.3 Production and evaluation of demonstrators

WP 4 Policy, recycling markets and business potentials

SIPtex will operate in an increasingly dynamic environment with new policy measures likely to be implemented, development of new textile recycling processes and floating (and emerging) recycling markets.

- Task 4.1 Role and impacts of policies
- Task 4.2 Analysis of existing and potential new markets
- Task 4.3 Development of business plan

WP 5 Project management and communication of results

- Task 5.1 Project management
- Task 5.2 Communication of project results
- Task 5.3 Preparation of Step 3 application