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| Energimyndighetens titel på projektet – svenska   |                       |
| Uppskalning av textilpappersmaterial på en pappersmaskin  |                       |
| Energimyndighetens titel på projektet – engelska  |                       |
| Up-scaling textile-paper materials on a paper-machine   |                       |
| Universitet/högskola/företag  | Avdelning/institution |
| RISE Innventia AB   | Bioekonomi            |
| Adress  |                       |
| Drottning kristinas väg 61, 114 86, Stockholm   |                       |
| Namn på projektledare   |                       |
| Mikael Magnusson  |                       |
| Namn på ev övriga projektdeltagare  |                       |
| H & M Hennes & Mauritz GBC AB, SOEX Textil-Vermarktungsgesellschaft m.b.H., Arctic Paper Munkedals AB, Swedbag AB |                       |
| Nyckelord: 5-7 st   |                       |
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## Förord

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## Innehållsförteckning

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## Sammanfattning

Detta projekt behandlade uppskalning av en unik klass av papper som kan användas inom modebranschen och innehåller en hög mängd återvunna textilier. Processer utvecklades för att förbättra textilpapperskvaliteten samt minimerade riskerna med att använda en textilavfallsström som en råvara i pappersteknisk infrastruktur. Projektet resulterade i en prototyp-produkt i form av textilpapperspåsar.

Textilludd är idag en avfallsström vid återvinning av textilier som vanligtvis förbränns. Den föreslagna papperskvaliteten introducerar dessa fibrer i det cirkulära materialflödet inom pappersindustrin och ökar värdet av sådant avfall till en unik klass av material som annars skulle förbrännas. Genom att uppgradera värdet av en avfallsström och återföra detta som en råvara till ett existerande cirkulärt materialflöde kan man både minimera koldioxidutsläpp samt öka livslängden på fibrer producerade i textilindustrin.

## Summary

The project addressed the production scale-up of a unique class of paper that can be used in the fashion industry and contains a high level of recycled textiles. Processes were developed for improving the textile paper quality and to minimize risks of using a textile waste stream as a resource. Also, prototype materials were produced on a pilot paper machine for the conversion into prototype shopping bags.

Today, textile lint is a waste stream from textile recycling and is typically incinerated. The proposed paper quality introduces these fibres into the circular material flow of paper industries and increases the value of such wastes to a unique class of materials. By upgrading the value of such a waste stream and introduce it as a raw material into an existing circular material flow it is possible to both minimize emissions of carbon dioxide as well as increase the lifespan of cotton fibres produced in the textile industry.

## Inledning/Bakgrund

The idea of this project was to upscale the production of a unique class of paper to be used in the retail fashion sector consisting of a high fraction of textile waste. Processes were developed, and materials were produced on a pilot paper machine for a proof-of-concept of the overall innovative solution, from raw material treatment to textile paper production. The project resulted in a prototype textile paper material series suitable for shopping bags, composed of waste textile fibres and traditional papermaking fibres. The pilot scale production was evaluated in terms of production guidelines for large scale production on an industrial paper machine. Retail fashion giant H&M has an interest to exploit the results as a way to promote textile recycling and to improve the sustainability of the fashion sector. Paper producer Arctic Paper has an interest to use the technical results for industrial

production of the textile paper. Textiles recycling service provider, SOEX, wants to find new uses for waste textile fibres that would otherwise be incinerated. And, Swedbag may convert the textile paper into end user products (shopping bags).

This project addresses one of the key factors prior to market implementation, i.e. a pre-condition for upscaling the textile paper manufacturing process with focus on fibre processing to make it suitable for the paper production environment

## **Genomförande**

The project was performed in several different pre-studies regarding efficient stock preparation of the special kind of raw material.

First, a preliminary bleaching study was performed. One of the key factors for reaching the market was identified as the ability to successfully bleach the textile lint to reduce risks of inks being passed to consumer fabrics and clothes. The two most common bleaching strategies (used in large volumes in the paper industry) was tested in a lab scale to find precursors for future studies.

Secondly, a strategy to increase the strength of the paper was studied in order to reach market standards.

Thirdly, the major part of the project was to upscale lab results of a combined refining and screening of the textile raw material to minimize waste particles, increase the quality as well as the reduction of risks for large scale industrial productions.

Finally, the refined and screened stock was used in a full scale paper machine pilot production and converted into prototype textile paper bags by Swedbag for evaluation at H&M.

## **Resultat**

The bleaching pre-study showed that chloride dioxide was highly effective in bleaching the textile lint while hydrogen peroxide was not. In general, the strategy of using Chloride dioxide is widely known in the paper making industry and is already implemented in large volume production. Moreover, the results showed that, traditional strength additives such as cationic starch are not easily implemented to this special class of materials. The results indicate that the starch is easily retained to the fibre but did not result in an increase of strength.

Moreover, a combined screening and refining stock preparation strategy was utilized to minimize the number of long cotton fibres, fibre bundles and waste particles to the final paper product. The earlier lab results were successfully

upscaled to pilot scale in the project and the subsequent contamination studies on the full scale paper machine showed promising insights in how to implement the processes in industrial production.

## **Diskussion**

Although the bleaching strategy was highly successful, special care must be taken in terms of water treatment if used in a paper mill. Also, it is very likely that a de-inking process, conducted prior to the stock preparation of the paper mill may be beneficial to reduce contaminating ink particles in the papermachine water circuits.

This special grade of raw material comes from post-consumer wastes and special care needs to be taken prior to paper production to reduce the amount of plastics and metals (from buttons and zippers) before entering the paper making processes. After such a cleaning step a special set-up of refining and screens should be used for a material conservative preparation of the pulp to be able to run efficiently on a paper machine.

The proposed introduction of the textile waste as a raw material in paper production would benefit the environment in a number of different ways:

- avoid emissions to air from incineration of textile wastes
- Increased resource efficiency of using waste as raw material
- Increase use of cotton fibres which is otherwise highly demanding of water and pesticide in its production
- Material conservative strategy for the stock preparation of such class of raw materials

## **Bilagor**

- Administrativ bilaga
- Sustainability declaration