Chemistry | Process Engineering | Textile Industry | Material science and engineering | Technology Offer

Cellulose-based micro- and super-microfibres produced as continuous yarn suitable for weaving and knitting

Field of application

The invention could be of interest to manufacturers of fibres, fabric, filters, special papers, hygiene article and cosmetics or further absorbing materials.

State of the art

Micro- and super-microfibres fabricated from synthetic polymers are currently widely used. They are at present manufactured by a two stage process, producing bicomponent fibres. In this process the actual fibre material is spun together with a matrix component which is removed in a second step. This process results in short super-microfibres which are in a loose and random form. They can therefore only be used for the manufacturing of non-woven fabric with an equally random textile structure.
Cellulose and its derivatives cannot be melted and can therefore not be processed into micro- or super-micro-fibres using the classic bicomponent weaving process. So far it has therefore been impossible to produce such fine fibres and fabric.

Innovation

A novel direct-spin process was developed and patented by the German Institute of Textile Chemistry and Chemical Fibres (ITCF) in Denkendorf, which allows for the first time the cost-efficient production of microfibres and super-microfibres of less than 0.1 - 0.5 dtex from cellulose and cellulose-2.5-acetate in the form of a continuous fibre in a single step process.
The attraction of this method is that for the first time this superfine fibre can be stored on a spool and subsequently processed further by weaving and knitting. This makes the fibres suitable for a broad range of applications, for example as filter material in industry and the household (tea bags), special paper or in hygiene applications as absorption material (tampons, ear buds) and the production of health care, cleaning and cosmetic articles (cleaning cloths, cotton buds).
The fibres exhibit a particularly large surface area (measured as surface area/g of fibres). Furthermore, it is possible to change and optimise the physical characteristics of the fibres via process control. This allows the production of superfine fabric which has the potential of innovative and improved characteristics.

Your benefits at a glance

- ✓ Continuous yarn of micro- and supermicro-fibres (< 0.1 - 0.5 dtex) based on cellulose
- ✓ Direct spin process: one step, cost efficient
- ✓ Possibility to manufacture extremely fine woven fabrics
- ✓ Increased fibre surface area and improved, tunable fibre characteristics

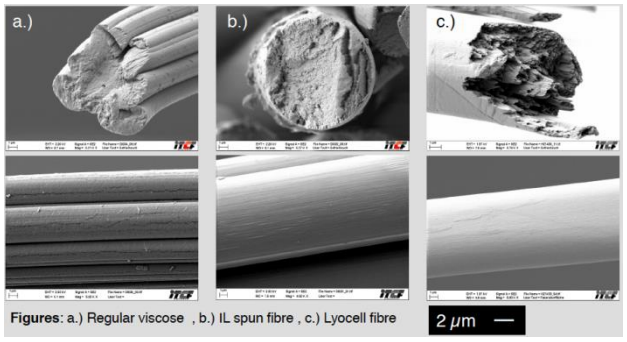

Figure 1: Super-microfine cellulose fibres produced by direct spinning from ionic fluid.

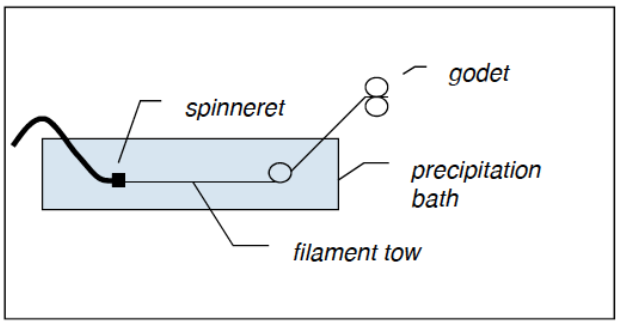

Figure 2: Schematic of direct spinning:
The cellulose which is dissolved in an ionic liquid is pushed through the micro-holes of a special spinneret and then coagulates into a fibre in the precipitation bath. The fibres can be stored as staple fibres or wound up as a continuous fibre and further processed.

Reference number: 11/095TLB

A process using a special spinneret

The novel direct spinning, respectively wet spinning process allows the cost-effective small volume production of continuous microfibres, respectively super-microfibres with a fineness of 0.1 - 0.5 dtex, corresponding to a fibre diameter of around 1 - 5 µm and a fibre surface area of around 1 - 4 m^2/g.
The cellulose which is dissolved in an ionic liquid is pushed through the micro-holes of a special spinneret which is optimised for this special application and then coagulated into a fibre in a precipitation bath.
Contrary to conventional processes, the novel direct spinning process offers a great degree of flexibility in its control. This opens the possibility to vary the physical characteristics of the fibres within a broad range and to optimise the product for specific purposes.

Process characteristics at a glance

- ✓ One step direct spinning of cellulose and its derivatives (e.g. Cellulose-2.5-Acetat)
- ✓ Use of a special spinneret with between 100 and 6000 micro holes of 10 to 45 µm diameter
- ✓ Direct solvent: ionic fluid
- ✓ Control of the characteristics of the fibre through flexible process control

Storage and preparation of the fibres

- ✓ As continuous fibre wound on a spindle
- ✓ As a staple fibre in different lengths

State of development

The Institute of Textile Chemistry and Chemical Fibres (ITCF) in Denkendorf, Germany offers excellent opportunities for the manufacture and characterisation of cellulose fibres as described herein and covered by the patent.
In the current year, it is the intention to develop the process for small volumes of up to 1 kg per type for a range of fibres, produce sample quantities of fibres and make them available for evaluation and testing.

Are you interested in material samples?

We are looking for industry partners and potential licensees to collaborate in tests and application specific evaluations.

Patent portfolio

A German patent ((DE 10 2012 005 489 B4) is granted.

Technology transfer

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licenses.

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