Abstract:
The invention relates to a method of manufacturing a nonwoven fabric, characterised by the use of chlorinated compounds. The nonwoven fabric is free of ecological flame retardants, and is suitable for use in all kinds of protection, being non-flammable and flame retardant.

Title: NONWOVEN FABRIC, A METHOD OF ITS PREPARATION AND ITS USE

Abstract: A nonwoven fabric characterised in that it consists of viscose fibres of 100% viscose content and optionally at least one flame retardant uniformly distributed on the nonwoven fabric at the amount 5 to 35 wt. %, the flame retardant being selected from ecological flame retardants free from antimonium compounds and chlorinated compounds. The invention relates also to a method of manufacturing the nonwoven fabric mentioned above and its use.
Nonwoven fabric, a method of its preparation and its use

Object of the invention is a nonwoven fabric, a method of its preparation and its use.

A use of polypropylene-based nonwoven fabrics in typography as a carrier of information is known. However, these nonwoven fabrics are not environment-friendly. There are also known nonwoven fabrics that exhibit high fire resistance. Usually, production of such fabrics involves chemical substances of various types i.e. flame retardants that enhance their fire resistance. Nonwoven fabrics of that kind are used e.g. in fire-fighting and in branches of industry where a use of non-flammable protective clothing is necessary.

From Polish Patent PL 191035, a method of manufacturing products in a form of polypropylene ribbons with added polyethylene, including antimonium trioxide and brominated hydrocarbon, preferably dibromobenzene, as flame retardants, is known.

From patents PL100666 i PL100667 slow-burning polyolefine blends for manufacturing fabrics, particularly polypropylene fabrics including - in addition to antimonium trioxide - organic halogenated compounds as flame retardants are known.

The invention relates to a viscose non-woven fabric, which does not include any other additives in the structure of non-woven fabric itself, and the applied flame retardants are ecological, i.e. they are environment-friendly, e.g. free from substances risky to environment.

Object of the invention is a nonwoven fabric characterised in that, it consists of viscose fibres of 100% viscose content and optionally at least one flame retardant uniformly distributed on the nonwoven fabric at the amount from 5 to 35 wt. %, the flame retardant being selected from ecological flame retardants free from antimonium compounds and chlorinated compounds.

The flame retardant is selected from a group consisting of ammonium sulfamate and phosphorus and nitrogen compounds.

Basis weight of the nonwoven fabric is from 30 to 250g/sq.m.

The nonwoven fabric includes overprinted information, particularly advertising information.

Object of the invention is also a method of manufacturing of non-flammable nonwoven fabric characterised in that, at least one ecological flame retardant free from
antimonium compounds and chlorinated compounds at the amount from 5 to 35 wt. % (referred to the dried product) is applied, by means of spraying aqueous solution or by immersing into an aqueous solution, onto a nonwoven fabric consisting of 100% viscose fibres.

Flame retardants selected from a group consisting of ammonium sulfamate and phosphor and nitrogen compounds are used.

An aqueous solution of flame retardants at concentration 8 to 20 wt. % is used.

Object of the invention is also a use of the above-mentioned nonwoven fabric in typography, as a carrier of overprinted patterns and/or information, particularly using offset process, digital techniques and silk-screen printing.

Object of the invention is also a use of the above-mentioned nonwoven fabric for manufacturing ecological products, particularly disposable goods, such as bedlinen, sleeping bags, protective clothing and tablecloths.

Object of the invention is also a use of the nonwoven fabric consisting of 100% viscose fibres as a carrier of information applied with offset process, digital techniques and silk-screen printing.

The new product makes it possible to eliminate or partially substitute non-biodegradable plastics based on polypropylene and polyethylene with a viscose nonwoven fabric having similar physical properties. Thus, an ecological product is obtained for applications in typography as a carrier of all types of overprinted information e.g. small as well as large-dimension posters, information panels and billboards, and also for suitably shaped overprinted surfaces, e.g. for production of protective covers, tents and canopies acting as a carrier of e.g. advertising information. The novel viscose nonwoven fabric includes modern, ecological flame retardants, free from harmful substances. So, the nonwoven fabric may be used in various types of rooms, buildings and on buildings, where strict requirements have to be met because of occupational safety provisions. The fabrics may also serve as aesthetic overprinted casings of buildings during repairs and refurbishment.

The viscose nonwoven fabric of the invention in an optionally overprinted form is also suitable for manufacturing of all types of disposable products such as bedlinen, protective clothing, disposable packaging (protective covers), sleeping bags, tablecloths, etc.
At present, flame retardants free from antimonium and chlorinated compounds are usually used, because of environmental protection.

Such flame retardants include natrium and potassium silicates, sulphates, e.g. ammonium sulphate, hydrates of aluminium oxide and aluminium oxide, phosphates, e.g. ammonium phosphate and polyphosphates, silicon poliacids, sulfamates, e.g. ammonium sulfamate, and sometimes borates and boric acid, although at present boriunm compounds are also eliminated. Particularly sulfamates, and phosphorus and nitrogen compounds, e.g. as salts, are used. These compounds can be optionally used as a mixture with cationic or nonionic surfactants, which improve adherence of flame retardants to a fibre surface.

The nonwoven fabric of the invention is made of textil raw material, which is 100% viscose fibre. A ready nonwoven fabric is free from other chemical substances like synthetic resins or latices. The fibre has a preparation, which makes it possible to process it on a production unit for forming fleece of nonwoven fabric. At the same time, because of the preparation no foam is formed when contacting with water, foaming being an effect undesirable at production of nonwoven fabrics by „spunlace” method.

Nonwoven viscose fabric has a wide basis weight range, i.e. 30-250 g/sq.m., which makes it possible to adjust the suitable thickness depending on typography needs and a purpose of overprinted nonwoven fabric surfaces.

Through combining two products - a flame retardant and a viscose nonwoven fabric an ideal ecological product has been obtained, suitable to be used in printing machines, e.g. in digital machines of plotter-type and in offset machines. The resulting nonwoven fabric has very advantageous physical properties, which make it possible to eliminate similar materials made of plastics, e.g. polypropylene derivatives, which have worse flammability characteristics.

The nonwoven fabric is produced on a unit equipped with a system checking thickness/ basis weight, linked together by a feedback to a part forming fleece of nonwoven fabric. Such solution makes it possible to manufacture products exhibiting high and repeatable uniformity degree. These parameters determine high quality of the nonwoven fabric of the invention.

The present manufacturing process of the nonwoven fabric typical process solutions. A unit of feeding with fibre is an element responsible for supervising over proper raw material mixing, preliminary opening of fibres and preparation of fibres to
carding process. A feeder and a carding machine are elements which are responsible for arrangement of uniform layer made of preliminary opened fibres and for carrying out carding process - complete opening of elementary fibres. The resulting fleece of nonwoven fabric is transferred to a cross-layerer, which is responsible for uniform arrangement of fleeces of nonwoven fabric, i.e. one on another. It makes it possible to adjust basis weight of nonwoven fabric. Furthermore, the device makes it possible to prepare fleece in such a way that in the final product a ratio of longitudinal strength to transverse strength is close to 1. It is particularly important for products which are to have technical applications.

A compensating device ensures an introduction of a new step in the production cycle, i.e. smooth transferring of loose fleece from the layerer to a gill box. In the gill box, the fleece arranged by the layerer is stretched, which improves fleece structure and facilitates its further processing - joining by means of water needles. In water needling machine, non-joined fleece of the nonwoven fabric is transferred onto a conveyor, where a stream of water needles hits it. A needling bar has 40 holes per 1 inch, through which water as water needles takes out under pressure up to 250 bars. Such directed water stream hits in the fleece of the nonwoven fabric and which becomes entangled while not destroying elementary fibres. A part of stream is reflected from the conveyor and crosses once more through the fleece entangling the fibres once again.

Such process makes it possible to produce tight nonwoven fabric of very high purity, and the product does not include any additional chemical substances. The resulting product is wet, thus it has to be dried prior to packaging.

At this step, through a use of additional elements and modification of settings of the unit, it is possible to make texture (projection) on a wet nonwoven fabric. A particular spatial pattern on a nonwoven fabric surface is obtained. Drying a wet nonwoven fabric is effected in a dryer. Temperature has be adjusted to dry the nonwoven fabric while not overheating it.

The production line is equipped with a control device - thickness gauge (a meter of basis weight) of nonwoven fabric, which measures the product as it is produced. The result is recalculated into a signal which is transferred to a part that controls the unit operation.

In the final step, on a winding machine, the finished product is wound onto wounds. Then, it is possible to cut the nonwoven fabric into pieces of a definite width.
The resulting nonwoven fabric has to be subject to a process of applying flame retardants. The process is carried out on a separate machine, which consists of a rewinder of nonwoven fabric, a device for applying the flame retardant, a dryer and a winding machine, on which finished non-flammable product is wound onto wounds.

Flame retardant is preferably used in a form of a solution and is applied onto a surface of nonwoven fabric by spraying or immersing into a flame retardant bath. Upon drying, optionally the flame retardant may be again applied onto the nonwoven fabric by spraying. The non-flammable nonwoven fabric upon drying contains 5 to 35% or 5 to 25% or 5 to 15 wt. % flame retardant.

Example 1

A viscose nonwoven fabric obtained on the production line described above and consisting of fibres of 100% viscose content and free from other chemical additives of a basis weight of 150 g/sq.m. upon drying was processed by applying aqueous solution of ammonium sulphamate. A flame retardant was applied by immersing the nonwoven fabric into an aqueous bath of ammonium sulphamate (10 wt. %). Upon taking out the nonwoven fabric from the bath, an excess of solution was squeezed, and the nonwoven fabric was dried. A non-flammable nonwoven fabric of basis weight 165 g/sq.m. was obtained.

Example 2

A viscose nonwoven fabric obtained on the production line described above and consisting of fibres of 100% viscose content and free from other chemical additives of a basis weight of 150 g/sq.m. upon drying was processed by applying an aqueous solution of ammonium phosphate. A flame retardant was applied by spraying the aqueous solution of ammonium phosphate (12 wt. %) onto the nonwoven fabric. Then, the nonwoven fabric was dried. A non-flammable nonwoven fabric of basis weight of 165 g/sq.m. was obtained.
Claims

1. Nonwoven fabric, characterised in that it consists of viscose fibres of 100% viscose content, and optionally at least one flame retardant uniformly distributed on the nonwoven fabric at the amount of 5-35 wt. %, the flame retardant being selected from ecological flame retardants, free from antimonium compounds and chlorinated compounds.

2. Nonwoven fabric of Claim 1, characterised in that the flame retardant is selected from a group including ammonium sulfamate, and phosphorus and nitrogen compounds.

3. Nonwoven fabric of Claim 1, characterized in that its basis weight is from 30 to 250 g/sq.m.

4. Nonwoven fabric of Claim 1, characterized in that it includes overprinted information, particularly advertising information.

5. Method of manufacturing non-flammable nonwoven fabric, characterised in that at least one ecological flame retardant free from compounds antimonium and chlorinated compounds is applied on the nonwoven fabric comprised of 100% viscose fibres by spraying an aqueous solution or immersing into an aqueous solution, the amount of the flame retardant being 5-35 wt. % referred to the resulting product upon its drying.

6. Method of Claim 5 characterised in that flame retardants selected from a group consisting of ammonium sulfamate, and phosphorus and nitrogen compounds are used.

7. Method of Claim 5 characterised in that the aqueous solution of flame retardants at concentration of 8 to 20 wt. % are used.

8. A use of the nonwoven fabric as defined in Claim 1 in typography, as a carrier of overprinted patterns and/or information, particularly involving offset process, digital process and silk-screen printing.

9. A use of nonwoven fabric as defined in Claim 1 for manufacturing of ecological products, particularly disposable goods, such as bedlinen, sleeping bags, protective clothing, tablecloths.
10. A use of nonwoven fabric consisting of 100% viscose fibres as a carrier of information applied by means of offset, digital and silk-screen printing techniques.
A. CLASSIFICATION OF SUBJECT MATTER
INV. D04H1/46 D04H1/74 D06M11/71 D06M13/438

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D04H D06M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Relevant to claim No</th>
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<tr>
<td>X</td>
<td>FR 2 750 564 A1 (DURRIS NICOLE [FR]) 9 January 1998 (1998-01-09) page 1, lines 21-27</td>
<td>1,3</td>
</tr>
<tr>
<td>X</td>
<td>US 2002/160681 A1 (NOELLE FREDERIC [FR]) 31 October 2002 (2002-10-31) example 1</td>
<td>1,3</td>
</tr>
<tr>
<td>X</td>
<td>US 5 631 071 A (FUKUNISHI AKIRA [JP] ET AL) 20 May 1997 (1997-05-20) example 1</td>
<td>1,4,8,10</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents

**A** document defining the general state of the art which is not considered to be of particular relevance

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**Ip** document published prior to the international filing date but later than the priority date claimed

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Name and mailing address of the ISA/
European Patent Office, P B 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040,
Fax (+31-70) 340-3016

Authorized officer
Barathe, Rainier
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<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>GB 1 552 692 A (BARD INTERNATIONAL LTD C R) 19 September 1979 (1979-09-19) the whole document</td>
<td>1</td>
</tr>
<tr>
<td>x</td>
<td>US 3 837 903 A (JONES G) 24 September 1974 (1974-09-24) examples 1,2</td>
<td>1,2,5-7</td>
</tr>
<tr>
<td>x</td>
<td>US 2 771 379 A (DI DARIO MARIO M) 20 November 1956 (1956-11-20) column 1, lines 28-32 examples 1,2 claims</td>
<td>1-3,5-7, 9</td>
</tr>
<tr>
<td>x</td>
<td>JP 2003 053868 A (KYOSEI KK) 26 February 2003 (2003-02-26) * abstract figures 2,3 paragraphs [0010], [0019]</td>
<td>1-4,8,10</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>---------------------------------------</td>
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<tr>
<td>FR 2750564 A1</td>
<td>09-01-1998</td>
<td>NONE</td>
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<td></td>
<td>AU 7530400 A</td>
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<td></td>
<td>JP 7331582 A</td>
</tr>
<tr>
<td>GB 1552692 A</td>
<td>19-09-1979</td>
<td>NONE</td>
</tr>
<tr>
<td>US 3837903 A</td>
<td>24-09-1974</td>
<td>NONE</td>
</tr>
<tr>
<td>US 2771379 A</td>
<td>20-11-1956</td>
<td>GB 750262 A</td>
</tr>
<tr>
<td>JP 2003053868 A</td>
<td>26-02-2003</td>
<td>NONE</td>
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