

Process of producing a cellulosic fibre web

The invention relates to a process of producing a cellulosic fibre web which may be further processed to air-laid paper, tissue or fluff. The invention also relates to a cellulosic fibre web obtainable from the process and air-laid paper, tissue, or fluff obtainable by further processing of the cellulosic fibre web.

Background of the invention

When manufacturing paper, especially air-laid paper, tissue and fluff, static electricity, measured as static potential, can be a problem. It can cause discharges or sparks, which disturb the production. Furthermore, if the dry fibres have a high static potential the fibres tend to glue themselves to process equipment such as mills, defiberizers and pipes. The fibres are accumulated and discharged as big lumps which create problems when forming the end product. Since the formation of the product usually is made from dry fibres, an even distribution of the fibres is important and lumps of fibres should be avoided. In the production of air-laid paper, uncontrolled static potential can result in extensive dusting which in turn can result in dust explosions. Attempts to reduce the static potential can also lead to deterioration of debonding agents, which may be added to enhance the softness of the product by interfering with natural fibre-to-fibre bonds that occur during sheet formation in the papermaking process.

WO 2007/058609 discloses a process in which the static potential of the fibres/paper product can be controlled and reduced while enhancing the softness of the produced paper product. However, it is desirable to further control the static potential. Also, it is desirable to obtain uniform spreading/dispersion of an antistatic agent. A further object is to increase the retention and effective use of an antistatic agent.

It is a further object of the present invention to provide a process that can considerably reduce the static potential by a small dosage of an antistatic agent without need of further additives.

According to one embodiment of the invention, it is a further object of the present invention to provide a papermaking process that can control the static potential while maintaining adequate softness of the product.

The invention

The present invention relates to a process of producing a cellulosic fibre web comprising

- a) providing a cellulosic suspension
- b) dewatering the cellulosic suspension and forming a cellulosic fibre web

c) applying a smectite clay in an amount from about 0.01 to about 2 kg/t dry cellulosic fibres to said cellulosic fibre web,

wherein no polymer is added to the formed cellulosic fibre web.

The present invention also relates to a process of producing a cellulosic fibre web comprising

a) providing a cellulosic suspension and adding a debonder system to the cellulosic suspension

b) dewatering the cellulosic suspension and forming a cellulosic fibre web

c) applying a smectite clay in an amount from about 0.01 to about 2 kg/t dry cellulosic fibres to said cellulosic fibre web.

The term "cellulosic fibre web" as used herein, includes any sheet or web prepared from cellulosic fibres such as pulp sheets or paper webs.

It has been found addition of smectite clay to a formed cellulosic fibre web prevents interaction of smectite with components present in the cellulosic suspension which may disturb the intended purpose, i.e. to provide controlled antistatic effect.

According to one embodiment, the smectite clay is added to the formed web in an amount from about 0.1 to about 2, for example from about 0.1 to about 1, or from about 0.1 to about 0.75, or from about 0.1 to about 0.5, or from about 0.1 to 0.25 kg/ton dry cellulosic fibres. According to one embodiment, smectite clay is added to the formed web in an amount from about 0.25 to about 0.75 kg/ton dry cellulosic fibres. According to one embodiment, the smectite clay is present in an aqueous dispersion. According to one embodiment, the smectite clay, for example in dispersion form, is sprayed on the web.

According to one embodiment, smectite clays which can be used according to the present invention include for example montmorillonite/bentonite, hectorite, beidelite, nontronite, saponite, and mixtures thereof. According to one embodiment, the smectite clay is laponite and/or bentonite.

According to one embodiment, the smectite clay can be modified e.g. by introducing a cation or a cationic group, such as a quaternary ammonium group or an alkali metal, for example lithium.

According to one embodiment, the smectite clay is a synthetic hectorite clay modified with lithium. This clay is sold under the name Laponite® from Rockwood or Eka Soft F40 from Eka Chemicals AB. Examples of such clays, and the manufacturing of such clays, include those disclosed in WO 2004/000729. The smectite clay used according to the present invention can have a specific surface area from about 50 to about 1500, for example from about 200 to about 1200, or from about 300 to about 1000 m²/g.

Suitable products may be for example Bentonite from Süd-Chemie, BASF and Clayton; Bentolite (Bentonite) from Southern Clay Products; and Hydrotalcite from Akzo Nobel.

According to one embodiment, the smectite clay can be applied by immersion of the cellulosic fibre web into a solution or dispersion of the smectite clay.

The aqueous dispersion of smectite clay can either be produced in advance or dispersed on site. According to one embodiment, the smectite clay is added as a powder.

5 According to one embodiment, no further component is added separately or in conjunction with smectite clay to the formed cellulosic fibre web.

According to one embodiment, smectite clay is also added to the cellulosic suspension, for example in an amount of from about 0.01 to about 10, such as from about 0.05 to about 5, or from about 0.1 to about 2 or from about 0.25 to about 1 kg/ton dry
10 cellulosic fibres.

According to one embodiment, the weight ratio of smectite clay added to the cellulosic suspension and smectite clay added to the cellulosic fibre web ranges from about 1:100 to about 100:1 for example from about 5:95 to about 80:20, or from about 10:90 to about 50:50, or from about 15:85 to about 40:60 or from about 20:80 to about
15 30:70.

According to one embodiment, a debonder system such as a debonder composition is added to the suspension. Whereas a debonder composition may comprise one or several components in a mixture which is added jointly or in conjunction to the cellulosic suspension, a debonder system may also involve one or several components
20 which are added separately to the cellulosic suspension.

According to one embodiment, a debonder system is added as a pre-mixed emulsion further comprising a polymer as defined herein.

According to one embodiment, the weight ratio of the debonder system to smectite clay ranges from about 1:50 to about 100:1, for example from about 1:10 to
25 about 50:1 or from about 1:5 to about 20:1, or from about 1:2 to about 10:1, or from about 1:1 to about 5:1.

According to one embodiment, the debonder system comprises

- (i) an oil, fat or wax,
- (ii) at least one non-ionic surfactant, and
- 30 (iii) at least one anionic surfactant

According to one embodiment, the debonder system comprises at least one quaternary ammonium surfactant.

According to one embodiment, refined and/or hydrogenated grade oils, for example vegetable oils like grape oil, olive oil, coconut oil, rape seed oil, sunflower oil and
35 palm oil, for example coconut oil is comprised in the debonder system.

According to one embodiment, mineral oils and/or silicon oil are comprised in the debonder system.

According to one embodiment, the debonder system is free or substantially free from quaternary ammonium surfactants. By "substantially free" is meant that quaternary ammonium surfactants constitute less than 5 wt%, for example less than 1, or less than 0.5 wt% of the total amount of the debonder system.

5 According to one embodiment, the debonder system, i.e. the total amount of component(s) making up the system, is added in an amount from about 0.1 to about 10, for example from about 0.3 to about 7, or from about 0.5 to about 5 kg/ton dry cellulosic fibres.

10 According to one embodiment, to avoid deterioration of the different additives, a preserving agent may be added. Several cosmetic additives can also be included, for example antioxidants, e.g. tocopherol, and aloe vera.

According to one embodiment, the cellulosic fibre web is further processed to produce air-laid paper, tissue or fluff. According to one embodiment, the paper produced is not printing paper or cardboard and/or paperboard.

15 The present invention also relates to a cellulosic fibre web obtainable by the process as described herein.

The present invention also relates to a cellulosic fibre web comprising smectite clay in an amount from about 0.25 to about 0.75 kg/ton dry cellulosic fibres wherein the static potential is lower than 5 kV.

20 According to one embodiment, the static potential of the cellulosic fibre web is lower than 10, or lower than 8, or lower than 6, or lower than 5 kV.

According to one embodiment, the defiberization energy of the cellulosic fibre web is lower than 120, such as lower than 110 or lower than 100 kJ/kg.

25 According to one embodiment, less than 10, for example less than 5 or less than 1 wt% of colloidal silica particles based on the weight of smectite clay are added to the formed cellulosic fibre web. According to one embodiment, no colloidal silica particles are added to the formed cellulosic fibre web. According to one embodiment, no or substantially no organophilic compound such as organophilic smectite or organophilic silicate is added to the formed cellulosic fibre web. According to one embodiment, no or
30 substantially no quaternary organic ammonium compound is added to the web. According to one embodiment, no or substantially no starch compound is added to the web.

35 According to one embodiment, colloidal silica particles are added to the formed cellulosic fibre web in an amount from about 0.01 to about 50, for example from about 0.02 to about 20, or from about 0.05 to about 10, or from about 0.1 to about 5 or from about 0.125 to about 2 or from about 0.25 to about 1 kg/ton dry cellulosic fibres..

According to one embodiment, the cellulosic fibre web has a dry content of from about 5 to about 99, for example from about 25 to about 95 or from about 50 to about 95 or from about 65 to about 95 or from about 80 to about 95 wt% based on the total weight of the web.

- 5 According to one embodiment, the cellulosic fibre web has a dry content from about 20 to about 70, for example from about 30 to about 60 or from about 35 to about 50 wt% based on the total weight of the web.

 According to one embodiment, at least one polymer such as non-ionic, amphoteric, and/or cationic polymers or mixtures thereof can be added to the cellulosic
10 suspension, in particular polymers which are highly charged. The polymer can be derived from natural or synthetic sources and can be linear, branched or cross-linked, e.g. in the form of particles. According to one embodiment, the polymer is water-soluble or water-dispersible.

 Examples of suitable cationic polymers include cationic polysaccharides, e.g.
15 starches, guar gums, celluloses, chitins, chitosans, glycans, galactans, glucans, xanthan gums, pectins, mannans, dextrans. Suitable starches include potato, corn, wheat, tapioca, rice, waxy maize, barley, etc. Cationic synthetic organic polymers such as cationic chain-growth polymers may also be used, e.g. cationic vinyl addition polymers like acrylate-, acrylamide-, vinylamine-, vinylamide- and allylamine-based polymers, for example homo-
20 and copolymers based on diallyldialkyl ammonium halide, e.g. diallyldimethyl ammonium chloride, as well as (meth)acrylamides and (meth)acrylates. Further polymers include cationic step-growth polymers, e.g. cationic polyamidoamines, polyethylene imines, polyamines, e.g. dimethylamine-epichlorohydrin copolymers, and polyurethanes. Further examples of suitable cationic organic polymers include those disclosed in WO 02/12626.

- 25 According to one embodiment, the polymer is selected from the group of polydiallyldimethyl ammonium chloride, polyamines, cationic starch, amphoteric starch, and polyamidoamine-epichlorohydrin (PAAE), polyethylene imines and polyvinylamines.

 The term "step-growth polymer", as used herein, refers to a polymer obtained by step-growth polymerization, also being referred to as step-reaction polymer and step-
30 reaction polymerization, respectively. The term "chain-growth polymer", as used herein, refers to a polymer obtained by chain-growth polymerization, also being referred to as chain reaction polymer and chain reaction polymerization, respectively.

 According to one embodiment, the polymer has a molecular weight of from about 10000 to about 10000000, for example from about 15000 to about 5000000, or from
35 about 40000 to about 1000000 g/mol.

According to one embodiment, an anionic polymer such as anionic step-growth polymers, chain-growth polymers, polysaccharides, naturally occurring aromatic polymers and modifications thereof is added to the cellulosic suspension.

According to one embodiment, the total amount of polymer added ranges from
5 about 0.01 to about 10, such as from about 0.1 to about 5 or from about 0.2 to about 2 kg/ton dry cellulosic fibres.

According to one embodiment, an aqueous solution containing the polymer is prepared in which the polymer content is from about 0.1 to about 50, such as from about 0.5 to about 25 wt% which subsequently is added to the cellulosic suspension.

10 According to one embodiment, the aqueous polymer solution is heated up to about 20 to about 70, for example up to about 25 to about 55°C. According to one embodiment, an emulsion of an emollient-surfactant blend and an aqueous solution containing the polymer is prepared with, a static mixer, a high shear device called ultra-
turrax or a homogenizer. The emulsion can then be cooled to room temperature. The
15 cooling can be performed for example by means of a heat exchanger.

According to one embodiment, an anionic surfactant and/or anionic microparticles such as anionic silica particles, for example anionic colloidal silica particles, smectite clays, or mixtures thereof are added to the cellulosic suspension.

According to one embodiment, the anionic colloidal silica particles as defined
20 herein are hydrophobically modified.

Colloidal silica particles which can optionally be added to the cellulosic suspension and/or the cellulosic fibre web may be derived from e.g. precipitated silica, micro silica (silica fume), pyrogenic silica (fumed silica) or silica gels with sufficient purity, and mixtures thereof. According to one embodiment, the silica particles are silanised as
25 described in WO2004/035474. The silica sol may also, typically, be produced from waterglass as raw material as disclosed in e.g. US,5,368,833.

. Colloidal silica particles and silica sols according to the invention may be modified and can contain other elements such as amines, aluminium and/or boron, which can be present in the particles and/or the continuous phase. Boron-modified silica sols
30 are described in e.g. US 2,630,410. The aluminium modified silica particles suitably have an Al₂O₃ content of from about 0.05 to about 3 wt%, for example from about 0.1 to about 2 wt%. The procedure of preparing an aluminium modified silica sol is further described in e.g. "The Chemistry of Silica", by Iler, K. Ralph, pages 407-409, John Wiley & Sons (1979) and in US 5 368 833.

35 The colloidal silica particles suitably have an average particle diameter ranging from about 2 to about 150, for example from about 3 to about 50, or from about 5 to about

40 nm. Suitably, the colloidal silica particles have a specific surface area from about 20 to about 1500, for example from about 50 to about 900, or from about 70 to about 600 m²/g.

According to one embodiment, anionic surfactants that can be used according to the invention are for example anionic surfactants with hydrophobic "tails" having from about 6 to about 30 carbon atoms. Examples of anionic surfactants are saponified fatty acids, alkyl(aryl)sulphonates, sulphate esters, phosphate esters, alkyl(aryl)phosphates, alkyl(aryl) phosphonates, fatty acids, naphthalene sulphonate (NAS), formaldehyde polycondensates, polystyrene sulphonates, hydrophobe-modified NAS, for example saponified fatty acids, alkyl(aryl)sulphonates, sulphate esters, phosphate esters, alkyl(aryl)phosphates, alkyl(aryl) phosphonates, and mixtures thereof.

According to one embodiment, the anionic surfactant and/or anionic microparticle is added to the cellulosic suspension in a total amount from about 0.001 to about 1, such as from about 0.005 to about 0.5, or from about 0.01 to about 0.1 kg/ton dry cellulosic fibres.

According to one embodiment, non-ionic surfactants that can be used according to the invention include generally ethoxylated or propoxylated fatty acids or fatty alcohols. The ethoxylated fatty acids and fatty alcohols can be ethoxylated with from about 1 to about 30 ethylene oxide (EO), or from about 4 to about 25 EO. The ethoxylated fatty acids and fatty alcohols may have from about 6 to about 30 carbon atoms, or from about 6 to about 22 carbon atoms. The propoxylated fatty acids and fatty alcohols may have been propoxylated with from about 1 to about 30 propylene oxide (PO), or from about 1 to about 8 PO. The propoxylated fatty acids and fatty alcohols can have from about 6 to about 30 carbon atoms, such as from about 6 to about 22 carbon atoms. It is also possible to use carbon dioxide instead of propylene oxide.

According to one embodiment, a non-ionic surfactant is added in an amount from about 0.1 to about 10, for example from about 0.3 to about 7, or from about 0.5 to about 5 kg/ton dry cellulosic fibres.

According to one embodiment, further conventional components may be added to the cellulosic suspension such as wet strength agents, dry strength agents and wetting agents.

According to one embodiment, the cellulosic fibres of the cellulosic suspension may include fibres derived from wood pulp, which includes chemical pulp such as, sulphite and sulphate pulps, as well as mechanical pulps such as ground wood, thermomechanical pulp and chemical modified thermomechanical pulp. Recycled fibres may also be used. The recycled fibres can contain all the above mentioned pulps in addition to fillers, printing inks etc. Chemical pulps, however, are preferred since they impart a superior feeling of softness to tissue sheets made from it. The utilization of

recycled fibres for making tissue or fluff often includes a process step known as deinking to remove as much as possible of the printing ink from the fibre slurry and most of the filler material to get an acceptable brightness of the recycled fibre slurry and paper machine runnability. The deinking process often includes addition of anionic substances
5 such as saponified fatty acids and water glass to the fibre slurry. These substances are sometimes carried over to the paper machine and due to the fact that they are anionic, they can inactivate cationic chemicals added to the stock. These substances are called anionic detrimental substances or "anionic trash".

To evaluate the performance of the papermaking process according to the
10 invention a number of parameters can be measured. To determine the static electricity the static potential is measured. The effect of the debonder system can be determined by measuring knot content, burst strength, defiberization energy and wetting rate. Low burst strength and low defiberization energy shows that the fibre-to-fibre bonds are weak, which enhances the softness.

15 The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the gist and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the claims. The following examples will further illustrate how the described invention may be performed
20 without limiting the scope of it. If not otherwise stated, all contents and percentages as described herein refer to weight percent.

Example 1

25 A coconut oil was mixed with a parasubstituted alkyl benzyisulfonic acid (~C12) (anionic surfactant) and an unsaturated fatty alcohol with 16 to 18 carbon atoms being ethoxylated with 5 EO (non-ionic surfactant). The contents of the components were 50 wt% oil, 1 wt% anionic surfactant, and 49 wt% non-ionic surfactants. The oil-surfactant blend was then heated to 50°C. Aqueous solutions with and without a Polyamine
30 Bewoten C410 (polymer) were prepared. The concentration of the polymer in the aqueous solution was 4 wt%. The aqueous solutions were heated separately to 50°C. The oil-surfactant blend was subsequently emulsified into the aqueous solutions by means of an Ultra-Turrax® (high-shear equipment). The compositions were subsequently cooled to room temperature in a water bath. The weight ratio of the oil-surfactant blend to
35 the aqueous solution was 15:85. The compositions prepared will in the following be referred to as debonder compositions D1 and D2 respectively.

The debonder compositions used in the examples:

D1: Eka Soft F61® composed of 3.4 wt% Polyamine Bewoten C410 and the oil-surfactant blend in aqueous solution

D2: Oil-surfactant blend (Eka Soft F60®) in aqueous solution

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The polymer used in the examples:

P1: Polyamine Bewoten C410 (Eka Soft F50®)

10 The silicious materials used in the examples are:

S1: Silica sol (Eka NP 320®)

S2: Eka Soft F40®, a synthetic hectorite, hydrous Sodium Lithium Magnesium Silicate.

S3: Composition containing S1 and S2 in weight ratio 1:1

S4: Composition containing S1 and S2 in weight ratio 2:1

15 S5: Composition containing S1 and Bentonite in weight ratio 1:1

S6: Composition containing S1 and Bentonite in weight ratio 2:1

S7: Composition containing S1 and Bentonite in weight ratio 1:1

20 The silicious materials, S1–S7, either as sole materials or mixtures thereof, were dissolved in water to form an aqueous solution with 1 wt% silicious material. Mixtures S3–S7 are defined in the schedule below:

Comp.	Dry weight ratio Silica:Smectite	NP320 (8 wt%)	Laponite® (6 wt%)	Bentonite (100 wt%)	Water
S3	1:1	75g (1)	100g (2)	-	-
S4	2:1	150g(1)	100g (2)	-	-
S5	1:1	100g(1)	-	8.0g (3)	92(2)
S6	2:1	100g(1)	-	4.0g (3)	46(2)
S7	1:1	100g(1)	-	8.0g (2)	92(3)

25 The numbers in brackets reflect the addition sequence. The compositions were treated with Ultra-turrax for 10 min at 10.000 rpm.

Dry paper sheets were prepared by mixing 15 grams of chemical pine sulphate pulp with water up to 750 ml. If used, the debonder compositions were added to the pulp

suspension followed by 10 minutes of agitation. If used, the silicious materials were added after 8 minutes of agitation. After 10 minutes the formed sheets were prepared in a standard PFI-sheet former (A4 sheets). The sheets were then pressed according to standard method SCAN C26:76. Finally, the sheets were dried on a cylinder to about 90-95% dry content and were then conditioned in a climate room at 23°C and 50% relative humidity. If the additives were sprayed, 10 ml of the diluted product was used, with a concentration appropriate to receive a certain dosage level. The spraying was either conducted on wet paper web after pressing (about 50% dry content) or on dried and conditioned paper web (about 93% dry content). If sprayed on dried and conditioned paper web, the sheets were dried and conditioned once again before measurements were made.

Example 2

In example 2 the defiberization energy and static potential were measured of sheets prepared from different combinations of debonder compositions added to the cellulosic suspension and silicious materials added to the sheets. The amount of debonder composition added to the cellulosic suspension was 2.0 kg/ton based on dry cellulosic fibres. The polymer (Polyamine Bewoten C410) was added in conjunction with the debonder composition or separately in an amount of 0.033 kg/ton based on dry cellulosic fibres. From 0 to 2.0 kg silicious material/ton dry cellulosic fibres was added to the sheets as set out in table 1. The debonder compositions, polymer and silicious materials were added either to the furnish (F) or sprayed on the dried and conditioned paper web (about 93 wt% dry content) (S). Dry paper sheets were prepared according to example 1. The static potential of the sheets was measured with an Electrostatic field measurement device (JCI 148) and a high voltage head JCI (John Chubb Instrumentation 140) connected to a pin-defiberizer. The defiberization is measured in kJ/kg and the static potential is measured in kVolt.

Table 1

Test No.	Additives	Total dosage of silicious materials									
		0 kg/ton (kJ/kg)(kV)		0.25 kg/ton (kJ/kg)(kV)		0.5 kg/ton (kJ/kg)(kV)		1.0 kg/ton (kJ/kg)(kV)		2.0 kg/ton (kJ/kg)(kV)	
1	None	165	7.0	-	-	-	-	-	-	-	-
2	Sprayed H ₂ O	159	6.5	-	-	-	-	-	-	-	-
3	P1(F)+D2(S)	80	13.0	-	-	-	-	-	-	-	-
4	D1(S)	90	13.0	-	-	-	-	-	-	-	-
5	D2(F)+P1(F)+ S2(F)	-	-	110	10.0	95	5.0	85	-4.7	-	-
6	D2(F)+P1(F)+ S2(F)+S1(F)	-	-	110	10.0	110	8.0	105	1.7	115	-6.4
7	D2(F)	155	7.0	-	-	-	-	-	-	-	-
8	D2(F)+P1(F)	115	12.5	-	-	-	-	-	-	-	-
9	D2(F)+P1(S)	125	10.0	-	-	-	-	-	-	-	-
10	D2(F)+P1(S)+ S1(S)	-	-	160	7.6	155	6.5	155	3.3	-	-
11 Inv	D2(F)+P1(F)+ S2(S)	-	-	105	1.4	105	4.0	100	5.5	-	-
12	D2(F)+P1(F)+ S1(S)	-	-	115	9.0	115	6.8	120	4.0	-	-
13 Inv	D2(F)+P1(F)+ S3(S)	-	-	100	5.2	110	5.0	110	1.3	-	-

It is evident from the results of Table 1 that a lower static potential can be reached more rapidly with a low dosage according to the invention.

5

Example 3

In example 3 the static potential of sheets was measured for sole silicious materials. From 0 to 2.0 kg silicious material/ton dry cellulosic fibres were added as set out in table 2. The silicious materials were added either sprayed on the wet paper web (about 50 wt% dry content) (SWP) or the dried and conditioned paper web (about 93 wt% dry content)(SDP). Dry paper sheets were prepared according to example 1. The static potential was measured in the same way as in example 2.

15

Table 2

Test No.	Additives	Dosage of silicious materials					
		0 kg/ton (kV)	0.125 kg/ton (kV)	0.25 kg/ton (kV)	0.5 kg/ton (kV)	1.0 kg/ton (kV)	2.0 kg/ton (kV)
1	S1 (SWP)	7.6	0.4	-5.4	-3.7	-2.2	-0.8
2	S2 (SWP)	7.6	-1.4	-3.0	-4.0	-4.3	-6.6
3	S1 (SDP)	7.5	0.7	0.7	0.5	-0.3	-0.5
4	S2 (SDP)	7.5	-3.9	-6.9	-8.5	-8.1	-7.3

It is evident from the results of Table 2 that a low static potential can be rapidly reached
 5 with a low dosage of smectite clay according to tests 2 and 4 of the invention.

Example 4

In example 4 the static potential of sheets was measured for sole silicious
 10 materials and combinations thereof. 0 to 0.5 kg silicious material/ton dry cellulosic fibres
 according to table 3 were added. The silicious materials were sprayed on the wet paper
 web (about 50 wt% dry content). Dry paper sheets were prepared according to example
 1. The static potential was measured in the same way as in example 2.

Table 3

Test No.	Additives	Dosage of silicious materials			
		0 kg/ton (kV)	0.125 kg/ton (kV)	0.25 kg/ton (kV)	0.5 kg/ton (kV)
1	None	7.0	-	-	-
2	Sprayed H ₂ O	6.1	-	-	-
3	S1	-	0.4	-5.4	-3.7
4	S2	-	-1.4	-3.0	-4.0
5	S3	-	-	-4.1	-4.6
6	S4	-	-	1.1	-3.0
7	S5	-	-	-0.6	0.7
8	S6	-	-	-0.1	1.4
9	S7	-	-	3.5	1.7

It is evident from the results of Table 3 that a low static potential can be rapidly reached
 5 with a small dosage of Laponite RD® according to the invention.

Example 5

In example 5 the static potential and the defiberization energy of the sheets
 10 prepared from a furnish containing a debonder composition and polymer were measured. The dried and conditioned paper web (about 93 wt% dry content) were prior to measurements also sprayed with Laponite® and Laponite®-starch mixtures. The amount of debonder composition added to the cellulosic suspension was 2.0 kg/ton based on dry cellulosic fibres and the polymer addition was 0.12 kg/ton based on dry cellulosic fibres.
 15 The total amount of silicious material added to the dried and conditioned paper web (about 93 wt% dry content) was varied between 0.125 to 1.0 kg silicious material/ton dry cellulosic fibres according to table 4. The Laponite®-starch mixture of S2 and OS (oxidised starch, Perfectamyl P 255 SH) was made in a weight ratio of S2 to OS of 1:3. Dry paper sheets were prepared according to example 1. The static potential and
 20 defiberization energy were measured in the same way as in example 2.

Table 4

Test No.	Additives	Total dosage of silicious materials									
		0 kg/ton (kJ/kg)(kV)		0.125 kg/ton (kJ/kg)(kV)		0.25 kg/ton (kJ/kg)(kV)		0.5 kg/ton (kJ/kg)(kV)		1.0 kg/ton (kJ/kg)(kV)	
1	D2(F)+P1(F)	120	9.7	-	-	-	-	-	-	-	-
2	D2(F)+P1(F) + S2-OS(S)	-	-	-	-	105	6.8	125	6.7	-	-
3	D2(F)+P1(F) +S2(S)	-	-	105	8.0	90	5.0	100	2.0	105	-0.3
4	D2(F)+P1(F) +S3(S)	-	-	-	-	-	-	110	3.6	-	-

- 5 It is evident from Table 4 that tests 3 and 4 according to the invention result in lower static potential and acceptable defiberization energy compared to test 2 in which a laponite-starch mixture was applied to the web.

Claims

1. Process of producing a cellulosic fibre web comprising
 - a) providing a cellulosic suspension
 - b) dewatering the cellulosic suspension and forming a cellulosic fibre web
 - 5 c) applying a smectite clay in an amount from about 0.01 to about 2 kg/t dry cellulosic fibres to said cellulosic fibre web,
wherein no polymer is added to the formed cellulosic fibre web.
2. Process of producing a cellulosic fibre web comprising
 - a) providing a cellulosic suspension and adding a debonder system to the cellulosic
10 suspension
 - b) dewatering the cellulosic suspension and forming a cellulosic fibre web
 - c) applying a smectite clay in an amount from about 0.01 to about 2 kg/t dry cellulosic fibres to the formed cellulosic fibre web.
3. Process according to claim 1, wherein a debonder system is added to the
15 cellulosic suspension.
4. Process according to any one of claims 1 to 3, wherein a polymer is added to the cellulosic suspension.
5. Process according to any one of claims 1 to 4, wherein the smectite clay is added in an amount from about 0.1 to about 1 kg/ton dry cellulosic fibres to the formed
20 web.
6. Process according to any one of claims 1 to 5, wherein the smectite clay is sprayed on the web.
7. Process according to any one of claims 2 to 6, wherein the debonder system comprises
 - 25 (i) an oil, fat or wax,
 - (ii) at least one non-ionic surfactant, and
 - (iii) at least one anionic surfactant.
8. Process according to any one of claims 2 to 6, wherein the debonder system comprises a quaternary ammonium surfactant.
9. Process according to any one of claims 2 to 8, wherein the weight ratio of
30 the debonder system to smectite clay added to the web ranges from about 1:50 to about 100:1.
10. Process according to any one of claims 1 to 9, wherein the smectite clay is laponite and/or bentonite.
11. Process according to any one of claims 1 to 10, wherein the static potential
35 of the cellulosic fibre web is lower than 10 kV.

12. Process according to any one of claims 1 to 11, wherein the defiberization energy of the cellulosic fibre web is lower than 120 kJ/kg.
13. Process according to any one of claims 1 to 12, wherein the cellulosic fibre web is further processed to produce air-laid paper, tissue or fluff.
- 5 14. Cellulosic fibre web obtainable by the process as claimed in any one of claims 1 to 13.
15. Cellulosic fibre web comprising smectite clay in an amount from about 0.25 to about 0.75 kg/ton dry cellulosic fibres wherein the static potential is lower than 5 kV.