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(57) **Abrégé/Abstract:**

The invention concerns a method for improving the printability and coatability of calendered paper and board. The method suggests the addition of polysaccharide and further, as a hydrophobic agent, at least a dispersed polymer which contains hydrophobic monomers, to the fiber stock in the production of the paper and board.



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(57) Abstract: The invention concerns a method for improving the printability and coatability of calendered paper and board. The method suggests the addition of polysaccharide and further, as a hydrophobic agent, at least a dispersed polymer which contains hydrophobic monomers, to the fiber stock in the production of the paper and board.



**WO 01/51708 A1**

Method for improving printability and coatability of paper and board

The invention relates to a method for improving the printability and coatability of paper in connection with its production. First of all the method aims to produce  
5 paper, which after calendering, either machine finished (MF) or super-calendered (SC) has gained smoothness and gloss properties well suited for printing.

The invention concerns also calendered and especially super-calendered paper, and the use of the paper for gravure printing, besides the use for off-set printing. Espe-  
10 cially the method produces paper having properties well suited for gravure printing, besides qualifying also the properties required for off-set printing.

The invention relates also a composition suitable for the production of the paper in question.

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The term "paper" is used in this connection to mean paper and board, which is produced using fiber from fiberizing methods which preserve lignin. Examples of this type of fiber are groundwood (GW), pressure groundwood (PGW), refiner groundwood and thermo-mechanical pulp (TMP). The invention is applicable also  
20 in paper production processes where chemically treated fiber is used. Such fibers include chemi-thermo-mechanical pulp (CTMP), as well as sulphate and sulphite pulps. The fiber may also have been processed only in mild chemical conditions for softening the lignin portion, such as NSSC-fiber and the like. The invention can be accomplished also using returned fiber, including de-inked fiber (DIP). The  
25 invention is workable both on bleached and unbleached fiber.

The fibers of aforementioned kind and mixtures thereof, usually containing a high proportion of lignin, are widely used for several printing paper grades. One exam-  
30 ple to be named is magazine paper.

Super-calendered (SC) magazine paper contains usually about 75 % of lignin-rich fiber, such as bleached groundwood. Unbleached sulphite fiber or semi-bleached sulphate fiber is used as reinforcing fiber. One portion of the lignin-rich fiber may also consist of thermo-mechanical refiner fiber, whereby the amount of the reinforcing fiber can be lower. This paper may contain filler material in an amount of 12 to 30%. The filler material promotes the achievement of good smoothness and gloss properties to super-calendered paper. The filler material may consist of kaolin, calcined kaolin, aluminosilicates, talc, calcium carbonate, both earth-based and precipitated (PCC), and the mixtures of the aforementioned materials. An advantageous paper producing process according to the invention involves the use of filler material in amounts of, preferably over 5%, more preferably over 10%, even more preferably over 15% and most preferably over 20%.

A usual newsprint furnish consists of a fiber mixture having a chemical pulp portion of about 10 to 20%, whereby the balance of fiber consists mainly of mechanical pulp, such as groundwood (GW), pressure groundwood (PGW), refined groundwood or thermo-mechanical pulp (TMP), but also de-inked waste paper (DIP) is used as part of the furnish. The waste paper replaces a part of the mechanical pulp.

The furnish for light-weight coated papers (LWC) contains a higher percentage of reinforcing fiber, up to 50%, and the balance consists of lignin-rich thermo-mechanical pulp or groundwood. The fibers produced in various methods are light bleached, the lignin-rich fiber using known lignin preserving methods, and chemical pulp using semi-bleaching methods. The use of filler material in the production of this paper grade is not customary. An exception also in this case is use of de-inked pulp bringing alongside usually unavoidable filler material, which has its own effects on the paper properties.

The paper disclosed in this application has at least machine-finishing, preferably it has been super-calendered, and most preferably it has undergone a finishing treat-

ment using modern calendering methods, including substrata moulding, which produce paper quality equal to or exceeding the super-calendered quality.

5 The high percentage of lignin-rich fiber in paper depresses the strength properties of the paper. The problems are traditionally encountered by adding to paper, in its production stage where the fibers still form a stock, so called stock starch, i.e. starch having an unbroken chain structure, usually at least 5 kg/ton. The starch usually has slightly amended cationic, anionic or amphoteric electro-chemical properties achieved by incorporating compounds to OH-groups in the starch monomer  
10 structure, which compounds produce cationic, anionic or amphoteric properties. The degree of substitution (DS) may be from 0.01 to 1, usually below 0.1, whereby the starch chain remains unbroken. The use of a proper stock starch improves the strength of the paper required for instance in printing and coating of the paper. In order to receive a high strength for the papers in question the starch usage may be  
15 up to 15 kg/ton. Especially a paper produced for off-set printing is made with a high percentage of stock starch for achieving the required strength and suitable liquid penetration properties. The amount of the starch applied is typically over 3 kg/ton of fiber.

20 A high percentage of starch in a paper, however, alters the paper properties and limits its usability. A high starch percentage renders the paper hard and stiff, whereby the compressibility is decreased. This has an adverse effect on the workability of the paper surface in calendering. The paper is also less suitable for gravure printing, where a good printing quality presupposes, besides high smooth-  
25 ness, a certain degree of compressibility. A paper produced to be applicable in off-set printing would possess, a fiber furnish composition suitable also for use in gravure printing, but the properties resulted from the use of starch prevent the use of the paper for this purpose. In the production of paper suitable for gravure printing, a stock starch addition of less than 1.5 kg/ton of fiber is usual.

It is also known to use a highly thinned cationic starch as protective colloid and retention aid for hydrophobic size-dispersions (such as AKD). However, this method does not produce strength and compressibility, which properties are characteristic to the paper produced by the method of the invention.

5

The problems encountered in papers produced from fibers having a high lignin percentage, and where the production traditionally involves the use of polysaccharide based size, such as starch for internal sizing, are, according to the invention obviated by adding to the fiber stock, besides a polysaccharide, as a hydrophobicity increasing agent, at least a dispersed polymer which contains hydrophobic monomers.

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The new composition according to the invention, being applicable in production of calendered and super-calendered paper grades for both off-set and gravure printing, contains afore mentioned polysaccharide and polymer dispersion.

15

The film forming temperature of the polymer is preferably from  $-50^{\circ}\text{C}$  to  $200^{\circ}\text{C}$ , more preferably from  $-25^{\circ}\text{C}$  to  $100^{\circ}\text{C}$  and most preferably from  $0$  to  $80^{\circ}\text{C}$ . The use of a such polymer, besides a polysaccharide, or replacement of a part of the polysaccharide with this polymer has resulted to a reduction in the stiffness and an improvement in the calendering behaviour of paper, and consequently a higher smoothness in the calendered paper has been achievable, still keeping the strength properties of the paper unchanged. This has a general beneficial effect to the paper printability. Paper may be produced to suit for off-set printing, and the additional improvement in the flexibility makes it suitable also in gravure printing.

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Compounds applicable in the production of the polymer dispersion include vinylacetate, butyl- and/or 2-ethylhexylacrylate, methylmethacrylate, acrylnitrile, styrene, alfa-methylstyrene and/or butadiene. In the production of the dispersion also polymerable anionic and/or kationic monomers can be used, such as different acids, amines and amides. Examples are acrylic acid, methacrylic acid, and acrylic amide.

30

The polymer dispersion consists preferably of acrylate, styreneacrylate, or styrenebutadiene copolymer. Preferably the polymer dispersion is produced by using emulsion polymerisation techniques, where the polymerisation is conducted in a water solution. The production technology is described for instance in the  
5 handbook: Peter A. Lovell and Mohamed S. El-Aasser, Emulsion Polymerisation and Emulsion Polymers, John Wiley and Sons, pp. 37 to 58.

Starch, mannan, carboxymethylcellulose, polyvinylacetate and/or emulgators can be used as a stabilizing agent in the production of the polymer dispersion, preferably  
10 bly cationic and/or oxidized starch is used as the stabilizing agent. The production of the polymer dispersion using starch as a stabilizing agent is described for instance in the WO publication 00/46264.

The polymer dispersion may be added in accordance with the invention in an  
15 amount of 0.5 to 20 kg/ton of fiber calculated on the dry matter of the dispersion and the total dry matter of the fiber composition. A preferred addition amount is 0.5 to 10 kg/ton of fiber, and a most preferred addition amount is 0.5 to 5 kg/ton of fiber.

20 In an application of the invention the polysaccharide may be starch, mannan or carboxymethyl cellulose (CMC), native, amphoteric or cationic, where the substitution degree (DS) of the anionic and/or the cationic groups in the polysaccharide chain is 0 to 2. The polysaccharide is preferably a cationic starch, where the substitution degree (DS) of the cationic groups in the starch chain is 0 to  
25 1, preferably 0.01 to 0.4, more preferably 0.01 to 0.2, even more preferably 0.01 to 0.1, and most preferably 0.01 to 0.05. The viscosity level of the polysaccharide is over 5 mPas (5%, 60°C, Brookfield), preferably over 100 mPas, more preferably over 300 mPas and most preferably over 400 mPas. Most preferably the polysaccharide has undergone no substantial thinning (viscosity over 400 mPas),  
30 and has a low cationic degree of substitution (DS 0.01 to 0.05). In the process of the invention the polysaccharide is added in an amount of about 0.1 to 15 kg/ton of

fiber, even 0.1 to 20 kg/ton, preferably 0.5 to 6 kg/ton, more preferably 1.5 to 5 kg/ton and most preferably 2 to 5 kg/ton of fiber.

When a polymer dispersion is used, which is stabilized with a synthetic polymer or with ionic monomers, it is preferred to use a cationic starch as polysaccharide, where the degree of substitution of the cationic groups is 0 to 2, preferably 0.02 to 1, more preferably 0.03 to 0.7, even more preferably 0.05 to 0.5 and most preferably 0.1 to 0.4. The viscosity level of the polysaccharide is preferably over 5 mPas (5%, 60°C, Brookfield), more preferably 50 to 2000 mPas and most preferably 100 to 500 mPas. The most preferred polysaccharide in this embodiment is partly thinned (viscosity 100 to 500 mPas) starch, mannan or carboxymethylcellulose (CMC) having a relatively high cationic degree of substitution (DS 0.1 to 0.4), especially starch. In exploitation of the invention the amounts of addition for this polysaccharide are within the range of 0.1 to 4 kg/ton fiber, preferably 0.1 to 3 kg/ton of fiber.

It has also been noticed that in practising the invention, the addition ranges for polysaccharides having the following degrees of substitution are:

|  | Cationic polysaccharide, DS | Minimum amount of addition, kg/ton fiber |
|--|-----------------------------|------------------------------------------|
|  | 0.01 to 0.05                | 2                                        |
|  | 0.05 to 0.3                 | 1                                        |
|  | 0.3 to 1                    | 0.5                                      |

It is also beneficial to use two or more different polysaccharides, whereby the addition shares are brought to comply with the aforementioned amounts.

The polymer dispersion and the polysaccharide may be added separately, but it is preferred that the addition on a paper machine is simultaneous, either as a finished

mixture, or together from the same addition point. The use of a finished mixture is most preferred.

The amount of the polysaccharide may also be divided in several parts, whereby one part is added together with the polymer dispersion or in an admixture with the polymer dispersion. The addition of the polymer dispersion and the polysaccharide together guarantee that they will be well mixed and, consequently, that a paper with equal properties is produced. The simultaneous addition improves also the effect of the polymer dispersion, whereby also the smoothness of the paper is improved.

When practising the invention, the hydrophobic properties of the paper may be increased by adding some other hydrophobic agent to the fiber stock in addition to the polymer dispersion. Preferably the addition is conducted simultaneously, i.e. from the same addition point or as a finished mixture. ASA, AKD or rosin sizes, for instance, may be used as such hydrophobic agents.

The invention will be explained more detailed by means of the following examples.

#### Example 1.

Paper (50 g/m<sup>2</sup>) was produced using 100% peroxide bleached thermo-mechanical pulp (TMP) having a dewatering degree of 70 °SR. Anionic calcium carbonate was further added to the fiber stock as filler in an amount of 10% of the total fiber composition. The fiber stock was admixed with cationic starch in each test point in an amount of 0.2%, the starch having a cationic substitution degree (DS) of 0.2. In test points 1, 2, 5 and 6 the fiber suspension was further admixed with stock starch in amounts of 0.2 or 0.4 % on the fiber composition, the starch having a cationic degree of substitution of 0.032. The retention aid used was Percol 162 and Hydrocol O, in the amounts of 0.02% and 0.17%, respectively. The polymer dispersion used was styrene-acrylnitrile-butyl-acrylate copolymer, which as a dispersion stabilizing agent contained cationic starch in an amount of 20% of the dispersion dry matter,

which starch had a degree of substitution of 0.2 in respect to the cationic groups.

The polymer dispersion was added simultaneously with the starch as a mixture. The percentages of each of the added chemicals are calculated as dry matter on the total dry matter of the fiber composition. The paper was given a machine finishing (MF) by calendering.

| Test point | Polymer dispersion added, % | Amount of starch (DS 0.035) added, % | Geometric tensile index, Nm/g | Geometric stiffness index, Nm/g | Scott Bond, J/m <sup>2</sup> | Porosity, Bedtsen, ml/min |
|------------|-----------------------------|--------------------------------------|-------------------------------|---------------------------------|------------------------------|---------------------------|
|            |                             |                                      |                               |                                 |                              |                           |
| 1          | 0                           | 0.2                                  | 30.7                          | 4.07                            | 268                          | 118                       |
| 2          | 0                           | 0.4                                  | 32.6                          | 4.83                            | 306                          | 117                       |
|            |                             |                                      |                               |                                 |                              |                           |
| 3          | 0.4                         |                                      | 31.9                          | 4.36                            | 220                          | 93                        |
| 4          | 0.8                         |                                      | 35.8                          | 4.66                            | 230                          | 107                       |
|            |                             |                                      |                               |                                 |                              |                           |
| 5          | 0.4                         | 0.2                                  | 32.1                          | 4.00                            | 313                          | 102                       |
| 6          | 0.8                         | 0.2                                  | 33.0                          | 4.01                            | 376                          | 97                        |

The test results show that by using polymer dispersion a more flexible paper can be produced, the paper still possessing a similar improved strength which can be achieved by using starch. Especially using a mixture of starch and polymer dispersion, the lowest paper stiffness, which is beneficial for gravure printing, and the highest internal bond strength, beneficial for the off-set printing, are achieved. The use of the polymer dispersion has also a beneficial effect to the porosity of the paper. A more dense paper prevents a coating colour to penetrate into the paper furnish, which improves the coating properties of a paper.

Corresponding conclusions can be drawn also on the basis of the following example 2, where the polymer dispersion, deviating from the previous example, is stabilized by a synthetic polymer. It may be noted from the test results, that when polymer dispersion is used, the porosity and the roughness, as well as the stiffness of the calendered paper are lower. The use of the polymer dispersion has a beneficial effect also to the internal bonding and tensile strength of the paper.

#### Example 2.

Paper (50 g/m<sup>2</sup>) was produced using 100% peroxide bleached thermo-mechanical pulp (TMP) having a dewatering degree of 70 °SR. The fiber stock was additionally admixed with a stock starch in an amount of 0.2% or 0.4% , which starch had a cationic substitution degree (DS) of 0.20, and with a retention aid Percol 162 and Hydrocol O, in the amounts of 0.02% and 0.17%, respectively. As polymer dispersion was used styrene-acrylnitrile-butylacrylate-trimethylammonium-propyl-metacryl-amidechloride copolymer including synthetic fatty-alcohol-etoxyate as a stabilizing agent. The polymer dispersion was added as a mixture together with the cationic stock starch. The paper was finished to correspond to machine finishing (MF) by calendering.

| Amount of polymer dispersion, % | Amount of stock starch, % | Geometric tensile index, Nm/g | Scott Bond, J/m <sup>2</sup> | Porosity, Bendtsen ml/min | Roughness, - Bendtsen ml/min | Stiffness index |
|---------------------------------|---------------------------|-------------------------------|------------------------------|---------------------------|------------------------------|-----------------|
|                                 |                           |                               |                              |                           |                              |                 |
| 0.4                             | 0.2                       | 31.9                          | 211                          | 223                       | 303                          | 4.23            |
| 0.8                             | 0.2                       | 32.7                          | 226                          | 183                       | 253                          | 3.95            |
| 0.8                             | 0.4                       | 33.0                          | 221                          | 279                       | 290                          | 4.26            |
|                                 | 0.4                       | 29.3                          | 188                          | 299                       | 315                          | 4.30            |

## Example 3.

Paper (60 g/m<sup>2</sup>) was produced using 70% thermo-mechanical pulp (TMP), which was bleached with dithionite, and 30% pine kraft pulp having a dewatering degree of 70 °SR. To the paper furnish was further added anionic kaolin as filler in an amount of 30% of the total fiber furnish, stock starch having a cationic degree of substitution DS of 0.035 (Raisamyl 135) in an amount of 0.5 %, and Percol 162 as a retention aid in an amount of 0.02 %. As polymeric dispersion was used styrene-acrylnitrile-butylacrylate copolymer, which as a stabilizing agent contained cationic starch in an amount of 35% on the total dry matter of the dispersion, which starch had been substituted to a degree of substitution of 0.2 with cationic groups. The added amounts of each of the chemicals is calculated as dry matter on the total dry matter of the fiber composition. A super calendered (SC) finish was given to the paper, and the values of porosity, smoothness and surface strength were measured, whereby the following values were obtained.

15

| Amount of stock starch, % | Amount of polymer dispersion, % | Porosity, PPS10, kPam <sup>2</sup> | Smoothness, PPS10, kPam <sup>2</sup> | Scott Bond, J/m <sup>2</sup> |
|---------------------------|---------------------------------|------------------------------------|--------------------------------------|------------------------------|
|                           |                                 |                                    |                                      |                              |
| 0.5                       |                                 | 0.169                              | 1.15                                 | 180                          |
| 1.0                       |                                 | 0.171                              | 1.18                                 | 263                          |
| 1.0                       | 0.3                             | 0.108                              | 1.13                                 | 397                          |
| 0.5                       | 0.6                             | 0.009                              | 1.11                                 | 271                          |

The results indicate that the polymer dispersion essentially improves the porosity and smoothness in a calendered paper, which properties are advantageous in gravure printing.

The use of a high amount of stock starch (10 kg/ton) in this example was intended to give to the paper as high as possible internal bonding strength which can be

achieved by a stock starch. The addition of the polymer dispersion still improved the internal bonding strength value, which means, that the previous strength level still can be reached, despite a lower amount of stock starch, when, besides the starch a polymer dispersion is added to the fiber stock. The paper produced is thereby  
5 suitable also for gravure printing.

#### Example 4.

Paper (40g/m<sup>2</sup>) was produced using 100% of peroxide bleached thermo-mechanical  
10 pulp (TMP). In addition, anionic calcium carbonate in an amount of 10% on the total fiber composition as filler, stock starch having a cationic degree of substitution DS of 0.35 in an amount of 0.05, as well as Percol 162 and Hydrocol O as retention aid in the amounts of 0.04% and 0.15, respectively, were used. The polymer disper-  
15 sion was styrene-acrylnitrile-butylacrylate copolymer, containing cationic starch as a dispersion stabilizing agent in an amount of 35% on the dispersion dry matter, the starch having a degree of substitution of 0.2 relative to the cationic groups. The added amounts of each of the chemicals are calculated on dry matter basis on the total dry matter of the fiber composition. A machine finishing (MF) was given to the paper by calendering. The printing tests were conducted using Prüfbau-labora-  
20 tory apparatus.

|    |                                          |                                                                   |                                               |                                                             |                                                             |                                          |
|----|------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------|
| 25 | Amount of<br>polymer<br>dispersion,<br>% | Amount of<br>colour<br>g/m <sup>2</sup> at a<br>density of<br>0.8 | Amount of<br>colour at a<br>density of<br>1.0 | Density at<br>a colour<br>amount of<br>0.8 g/m <sup>2</sup> | Density at<br>a colour<br>amount of<br>1.0 g/m <sup>2</sup> | Geomeric<br>tensile<br>strength<br>index |
|    | 0                                        | 0.94                                                              | 1.37                                          | 0.73                                                        | 0.82                                                        | 11.16                                    |
|    | 0.1                                      | 0.88                                                              | 1.36                                          | 0.76                                                        | 0.87                                                        | 11.33                                    |
|    | 0.3                                      | 0.86                                                              | 1.3                                           | 0.77                                                        | 0.88                                                        | 12.74                                    |

The results in the table indicate that when, besides starch a polymer dispersion is added, a print quality of a certain density level is achievable using a lower amount of colour and, correspondingly, a certain amount of colour produces a better print quality, than what is achievable when a calendered paper is used which is produced without an addition of polymer dispersion. When polymer dispersion was used the paper possessed also higher tensile strength values, which are also beneficial for a calendered paper used for printing.

#### Gloss of printed surface

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| Amount of<br>polymer disper-<br>sion, % | Gloss, %, at the<br>colour amount of<br>1.0 g/m <sup>2</sup> | Gloss, %, at the<br>colour amount of<br>1.5 g/m <sup>2</sup> | Gloss, %, at the<br>colour amount of<br>2.0 g/m <sup>2</sup> |
|-----------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------|
|                                         |                                                              |                                                              |                                                              |
| 0                                       | 14.7                                                         | 16.2                                                         | 18.5                                                         |
| 0.1                                     | 16.7                                                         | 17.8                                                         | 19.8                                                         |
| 0.3                                     | 16.2                                                         | 18.7                                                         | 22                                                           |

20

The gloss of paper is always higher when polymer dispersion is used in the internal sizing than what can be achieved using starch only in the internal sizing.

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The enclosed drawing figure illustrates the water penetration depending on time on calendered papers produced according to the Example 4. The measures were conducted using a DPM (Dynamic Penetration Measurement) apparatus. A conclusion can be drawn, that the polymer dispersion decreases the water penetration speed, which is beneficial both in printing and coating of calendered paper. The beneficial meaning of this paper feature for printing processes has been described in the magazine: IPW, No. 5/99, pages 72 to 74, Future Demands on Printing Paper.

The paper according to the invention, produced using a polysaccharide having a degree of substitution relative to compounds with an electric charge in the range of 0.01 to 1.2, and further the aforementioned polymer dispersion, which contains hydrophobic monomers, has been proven to be especially suitable for use in gravure printing. By implementing the invention it was possible to increase the percentage of the polysaccharide in a paper suitable for gravure printing without a negative effect to properties of the paper, such as compressibility, required from a paper suitable for gravure printing. The paper is suited for gravure printing even, when the percentage of the polysaccharide is over 1.5 kg/ton of fiber, preferably over 2 kg/ton, more preferably over 2.5 kg/ton, still more preferably over 3 kg/ton, still more preferably over 3.5 kg/ton, even more preferably over 4 kg/ton, most preferably over 5 kg/ton, and even over 8 kg/ton of fiber.

A paper used in gravure printing must usually have a polysaccharide percentage in the range of 0.1 to 20 kg/ton of fiber, preferably of 0.5 to 10 kg/ton of fiber and most preferably of 1 to 5 kg/ton fiber. In certain applications it is preferred to use at least 3.7 kg/ton of fiber.

The degree of substitution of the polysaccharides relative to compounds with an electric charge has a relation to the amount of the use within the following ranges:

|    | Degree of substitution,<br>DS | Amount used,<br>kg/ton of fiber | Preferred amount of use,<br>kg/ton |
|----|-------------------------------|---------------------------------|------------------------------------|
| 25 | 0.01 to 0.05                  | 2 to 15                         | 3 to 8                             |
|    | 0.06 to 0.29                  | 1 to 12                         | 1.5 to 7                           |
|    | 0.3 to 0.7                    | 0.1 to 4                        | 0.5 to 3                           |
|    | 0.71 to 1.2                   | 0.1 to 3                        | 0.5 to 1.5                         |

**Claims:**

1. A method for improving the printability of calandered paper and board, produced at least partly from fibers selected from the group consisting of groundwood, pressure groundwood, refined groundwood, thermomechanical pulp, de-inked waste paper and NSSC containing fiber composition, said method comprising adding to the fiber stock in the production of said paper and board a polysaccharide selected from the group consisting of starch, mannan and CMC, and at least one polymer dispersion comprising at least one dispersed polymer wherein said at least one polymer is obtained from monomers comprising hydrophobic monomers.
2. The method according to claim 1, wherein at least a part of the polysaccharide is added simultaneously with the hydrophobic polymer dispersion either as an admixture or at the same addition point.
3. The method according to claim 1, wherein a cationic, nonionic and/or anionic starch is added as the polysaccharide to the fiber stock.
4. The method according to claim 3, wherein a cationic starch having a degree of substitution of 0.02 to 2 in the starch chain is added as the polysaccharide to the fiber stock.
5. The method according to claim 3, wherein a cationic starch having a degree of substitution of 0.02 to 0.4 in the starch chain is added as the polysaccharide to the fiber stock.
6. The method according to claim 1, wherein cationic, nonionic and/or anionic mannan is added as the polysaccharide to the fiber stock.

7. The method according to claim 6, wherein cationic mannan having a degree of substitution of 0.02 to 2 in the mannan chain is added as the polysaccharide to the fiber stock.
8. The method according to claim 1, wherein a polymer dispersion is used, in the production of which styrene, butadiene, vinyl-acetate, acryl-nitrile, and/or acrylates have been used.
9. The method according to claim 1, wherein a polymer dispersion is used, in the production of which cationic, nonionic and/or anionic polymers and/or monomers have been used.
10. The method according to claim 1, wherein a polymer dispersion is used, in the production of which a cationic, nonionic, and/or anionic polysaccharide has been used.
11. The method according to claim 10, wherein a polymer dispersion is used, in the production of which a cationic, nonionic and/or anionic starch has been used.
12. The method according to claim 10, wherein a polymer dispersion is used, in the production of which cationic, nonionic and/or anionic mannan has been used.
13. The method according to claim 1, wherein a polymer dispersion is used, in the production of which at least one vinyl monomer has been used.
14. The method according to claim 1, wherein a polymer dispersion is used which has been produced with emulsion polymerisation.
15. The method according to any one of claims 1 to 14, wherein the polymer dispersion is used in an amount of 0.5 to 20 kg/ton of paper calculated as the dispersion dry matter and the dry matter of the total fiber composition.

16. The method according to claim 15, wherein the polymer dispersion is used in an amount of 0.5 to 10 kg/ ton of paper calculated as the dispersion dry matter and the dry matter of the total fiber composition.
17. The method according to claim 15, wherein the polymer dispersion is used in an amount of 0.5 to 5 kg/ ton of paper calculated as the dispersion dry matter and the dry matter of the total fiber composition.
18. The method according to any one of claims 1 to 17, wherein a fiber composition is used in the production of the paper, which consists of lignin containing, chemically treated fiber or de-inked fiber or a mixture of the aforementioned fiber types.
19. The method according to any one of claims 1 to 18, wherein filler material is used in the production of the paper in an amount of over 5% calculated as dry matter on the total dry matter of the fiber composition.
20. The method according to any one of claims 1 to 19, wherein filler material is used in the production of the paper in an amount of over 10% calculated as dry matter on the total dry matter of the fiber composition.
21. The method according to any one of claims 1 to 20, wherein filler material is used in the production of the paper in an amount of over 15% calculated as dry matter on the total dry matter of the fiber composition.
22. The method according to any one of the claims 1 to 21, wherein filler material is used in the production of the paper in an amount of over 20% calculated as dry matter on the total dry matter of the fiber composition.
23. The method according to any one of claims 1 to 22, wherein, besides the polymer dispersion, a further hydrophobic agent is added to the fiber stock.

24. The method according to claim 23, wherein alkenyl-succinic acid is added as the further hydrophobic agent.
25. The method according to claim 23, wherein a rosin size is added as the further hydrophobic agent.
26. The method according to claim 23, wherein an alkyl-ketene-dimer is added as the further hydrophobic agent.
27. The method according to any one of the claims 1 to 26, wherein the polysaccharide is added to the fiber stock in an amount of 0.1 to 20 kg/ton of fiber.
28. The method according to claim 27, wherein the polysaccharide is added to the fiber stock in an amount of 0.1 to 15 kg/ton of fiber.
29. The method according to claim 27, wherein the polysaccharide is added to the fiber stock in an amount of 0.5 to 6 kg/ton of fiber.
30. The method according to claim 27, wherein the polysaccharide is added to the fiber stock in an amount of 0.1 to 3 kg/ton of fiber.
31. The method according to claim 27, wherein the polysaccharide is added to the fiber stock in an amount of over 1.5 kg/ton of fiber.

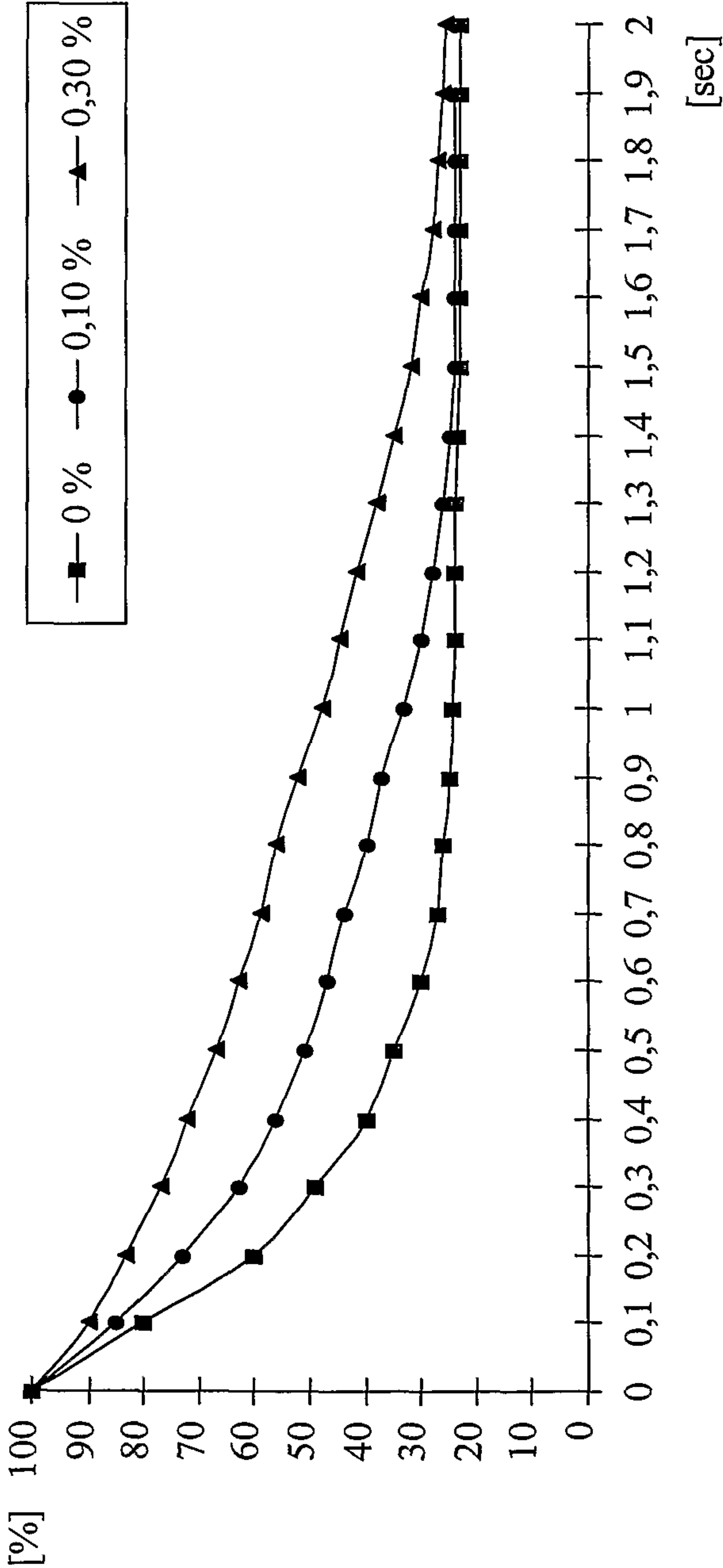


FIG. 1