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- (54) **PAPIER JOURNAL**
- (54) **NEWSPRINT**

(57) A new newsprint for the newspaper press using cold-set ink is disclosed. The newsprint comprises a base stack composed mainly of mechanical pulp and a coating layer comprising up to 30% of a needle form pigment. The average oil absorptiveness of the pigments in the coating layer should be greater than 65 cc/100g. The newsprint is especially useful for high quality multicolor printing on the high speed web-fed presses using cold-set ink and is characterized by an improved reproducibility of dots and sharpness of print pattern compared with usual newsprint.



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ABSTRACT OF THE DISCLOSURE

A new newsprint for the newspaper press using cold-set ink is disclosed. The newsprint comprises a base stack composed mainly of mechanical pulp and a coating layer comprising up to 30% of a needle form pigment. The average oil absorptiveness of the pigments in the coating layer should be greater than 65 cc/100g. The newsprint is especially useful for high quality multicolor printing on the high speed web-fed presses using cold-set ink and is characterized by an improved reproducibility of dots and sharpness of print pattern compared with usual newsprint.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a newsprint, in particular to a newsprint which is suitable for the multicolor news printing with cold-set ink on high speed newspaper presses.

2. Prior Art

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Recently, printing speed is rapidly increasing and the percentage of multicolor printing is also increasing due to the development of several new technologies. This tendency is now also common for news printing. However, the multicolor news printing must be performed in the usual manner, namely, on the high speed presses using common newsprint and penetration type cold-set ink, because mass production and low printing cost are required.

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However, the printability of the conventional method mentioned above, especially the color and the sharpness, has been very poor comparing to that of coated paper, and had less impact on human eye. Accordingly, the conventional method can not be applied to color pages or multicolor leaflet because they need good printing appearance. Usually, other printing methods are used for such purposes.

Several methods to improve the printing quality have been suggested. One of these methods is the use of heat-set ink instead of cold-set ink. In this case, the printing is performed on presses equipped with dryers using heat-set ink and newsprint. However, the cost of equipment and printing is relatively high.

An alternative method is the combination of cold-set ink, high grade papers and the high speed newspaper press without dryers. When usual coated paper, such as woodfree or wood containing paper, is used, it is impossible to obtain satisfactory results, except for low printing speed, because the cold-set ink is not sufficiently dried at high speed when printing is carried out without dryers.

10 According to another method a clear coating of paper is used to improve the paper printability. In this case, a solution of sizing agents or high molecular weight materials without pigment is coated on the base paper with conventional coaters, such as the size press. However, also in this case it is difficult or impossible to obtain good printing performance using cold-set ink, because the ink absorptiveness of the paper decreases with increasing sizing degree.

20 According to still another method, uncoated papers, such as fine paper, are used to improve the printability. However, even if the sizing degree of the fine paper is same as that of newsprint, the difference of the printability between the fine paper and newsprint is limited to the better reproducibility and contrast for monochrome parts. The color reproducibility and sharpness of the mixed color does not improve. When the calendered fine paper is used to obtain the print gloss, the printing speed must be set at lower level because of ink setting problems.

Pigment coated or clear coated newsprint showed similar tendencies as common coated papers described above,

because the surface properties were mainly determined by the coating layer. Consequently, the results of the multicolor printing using coated newsprint and cold-set ink on the high speed presses were not satisfactory.

As discussed above, there is no kind of paper with which the satisfactory printing speed and good multicolor printing can be obtained. Additionally, it is impossible to achieve the results with the conventional technologies or combination of conventional technologies. Accordingly, a new kind of paper has been strongly desired.

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SUMMARY OF THE INVENTION

One object of this invention is to provide a paper for which the same level of sharpness and reproducibility of printing as for a coated paper can be achieved, while maintaining the other properties of the newsprint, such as immediate ink setting, surface strength, opacity, and folding quality.

Thus the present invention provides a newsprint for the newspaper press using cold-set ink, which newsprint comprises a base stock composed mainly of mechanical pulp, and a coating layer comprising a needle form pigment, wherein an average oil absorptiveness of pigments in said coating layer is more than 65 cc/100 g.

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DETAILED DESCRIPTION OF THE INVENTION

According to the invention, a coated newsprint is used, the coating layer of which contains pigments whose average absorptiveness is more than 65 cc/100 g. It was found that a

better print gloss could be obtained by using a base stack composed mainly of mechanical pulp and a coating layer comprising a needle form pigment, wherein an average oil absorptiveness of the pigment in the coating layer was more than 65 cc/100 g.

The base paper used for this invention was 40 - 52 g/m² mechanical pulp based paper that contains usual fillers, and a small amount of water soluble high molecular retention agents, as needed. This base paper must satisfy the properties which are necessary for the printing with cold-set ink on high speed press. In other words, physical properties, such as tensile strength, tear strength and elongation, should be at the same level as those of usual newsprint.

The mechanical pulp includes, for example, a ground wood pulp, thermomechanical pulp, semichemical pulp, recycled mechanical pulps produced by deinking of newspaper or magazines containing these pulps, and broke in paper making. These pulps can be used as such or mixed at desirable ratios. A small amount of chemical pulp can be added for the adjustment of the optical properties, in the range it does not deteriorate the physical properties of mechanical pulps.

Known pigments can be used as the filler. For example, clay, talc, titanium dioxide, white carbon, calcium carbonates and urea resin fine particles can be used. The preferable amount of these materials is usually from 0.5 to 10%, more preferably less than 0.5%. If the amount is far less than 0.5%, it causes poor opacity or oil absorptiveness. On the other hand, if the amount

is far more than 10%, tensile strength or tear strength tend to decrease.

The needle shape pigments contained in the coating layer are the pigments having the ratio of the length to width of particles of at least 3 to 1, preferably 5 to 1. Single pigment or mixtures of such pigments can be used. In the case when the needle shape pigments are mixed with other pigments, it is preferable to use more than 20 weight percent, more preferable 30 weight percent of needle shape pigments.

10 The average oil absorptiveness of all pigments in coating layer must be more than 65 cc/100 g, preferably from 75 cc/100 g to 150 cc/100 g. In the case when the oil absorptiveness is less than 65 cc/100 g, the high speed printing using cold-set ink is impossible, because the set-off of the ink occurs. When the oil absorptiveness is more than 150 cc/100 g, the fluidity of the coating color tend to decrease and it causes problems on the coaters, such as the blade coater or the gate roll coater. Pigment formulations with single pigment or mixed pigments can be used. In the case when pigments whose oil absorptiveness is less than 65
20 cc/100 g and pigments whose oil absorptiveness is more than 65 cc/100 g are mixed, the formulations should be designed to achieve the average oil absorptiveness of more than 65 cc/100 g and the amount of the pigments having the high oil absorptiveness be more than 15 weight percent, preferable 20 weight percent. When the parts of the high oil absorptiveness pigments is less than 15 weight percent, set-off and/or rub-off could partially occur. Here,

the rub-off means the phenomenon that printed ink drops out in multi-printed parts because of inadequate drying of the ink.

The pigments which can be used are, for example, various kinds of silicon dioxide, activated clay, calcined clay, fine magnesium carbonate, various kinds of silicate, diatomaceous earth, urea resin powder as representative of those with high oil absorptiveness, and kaolin, talc, various kinds of calcium carbonate, titanium dioxide, zinc white as representative of those with low oil absorptiveness. The pigments with low oil absorptiveness, in this case, are not used alone, but are used as mixtures with the pigment with high oil absorptiveness.

The main reason for the use of the pigments with low oil absorptiveness is the control of the coating color properties, because the coating properties of the pigments with high oil absorptiveness are generally poor. The needle shape pigments are, for example, satin white, needle form precipitated calcium carbonate, and Hongkong kaolin, and the oil absorptiveness of those pigments vary in a wide range. These pigments are mixed with binders and applied on the base paper as the coating color.

Binders, for example styrene butadiene latex, starch and starch derivatives, polyvinyl alcohol and cellulose derivatives are commonly used. However, the choice of binders not limited, to these examples and other binders which are used for paper making can be used, alone or in admixtures. It is important to choose the kind and formulation of the binders in such a way as to obtain necessary surface strength at minimum amount of the binder and not

to decrease the absorptiveness of the pigments. For this purpose, polyvinyl alcohol and styrene butadiene latex are preferred.

When preparing coating colors other common additives, such as insolubilizers, dispersants and lubricants, may be added to the coating colors composed of pigments and binders.

All kinds of coaters used commonly in the paper industry, such as gate roll coater, blade coater, and air knife coater can be used. A machine coater is preferred from the view point of the production cost.

10 One side or two sides of the base paper are coated on the coater. In the case when both sides are printed, the both sides must be coated. In the case when only one side is printed, the printed side should be coated. Even if only one side is printed, the other side may be slightly coated in order to decrease the difference between the two sides. The handling in the printing and storing becomes easier with decreasing difference between the two sides.

20 The coat weight of the printed side is usually from 1 to 12 g/m², preferably from 3 to 8 g/m², and total basis weight including the base stock is preferably less than 60 g/m². When the coat weight is less than 1 g/m², the print appearance is occasionally poor. On the other hand, when the coat weight is more than 12 g/m², the stiffness tends to be less than the level required for newsprint.

According to the printing quality, smoothing treatment of the paper, such as supercalendering and/or machine calendering,

may be applied. However, excessive smoothing treatment is not preferred, because it may cause the decrease of brightness, ink setting and paper strength. Especially the decrease of stiffness may cause the problems on the folders.

10 In the case when the newsprint according to the invention is used for printing on a high speed press using cold-set ink, the ink is immediately absorbed and/or adsorbed. The part of ink which is not absorbed or adsorbed by the pigments reaches the base paper. Because the base paper has the same level of oil absorptiveness as usual newsprint, the total oil absorptiveness is extremely high and the ink is absorbed and/or adsorbed very rapidly. Accordingly, the multicolor printing can be performed at high speed.

20 Kaolin clay, the crystal form of which is rhombohexagonal (Hexagonal plate), is usually used as a major pigment for the coating layer of common coated paper. Because of the crystal form of kaolin clay, kaolin particles have tendency to be in the parallel orientation under the smoothing treatment, and to give a highly glossy surface. However, in the case when the high speed printing using cold-set ink is performed on such a coating layer, the ink does not immediately penetrate into the coating layer, and the set-off occurs.

Additionally, if multicolor printing is performed, each color ink flows on the surface of the coating layer, because ink penetration into the coating layer is slow. As a result, ink mixing occurs and the reproducibility of color is poor.

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On the other hand, when the pigments with high oil absorptiveness mentioned in this invention are used, ink is immediately set in the coating layer and the flow toward the coating layer is reduced. Accordingly, the reproducibility of color is good because every color is independently set. Furthermore, when needle form pigments are contained in the pigment formulations and the average oil absorptiveness of the pigments in the coating layer is more than 65 cc/100 g, the coating layer becomes smoother, the sheet gloss and print gloss become as high as those of usual coated paper. Consequently, every color in the multicolor printing can be clearly identified, and reproducibility and sharpness of colors are at the level required for the usual commercial multicolor printing.

Examples

The present invention is described by the examples. However, these examples are intended to illustrate the invention, and the present invention is not limited to these examples. The methods, used to evaluate various physical characteristics measured in these examples are described below.

20 (1) Oil absorptiveness of pigments.

This property is measured according to JIS K5101. When this measurement is applied to a mixture of pigments, these pigments must be previously well mixed.

When the pigment is in a slurry form, a sample of the slurry (from 1 to 10 g of dry substance) is diluted with pure water, the diluted slurry poured onto the glass plate (area of

about 1 m^2) with side banks, the plate sealed in order not to be contaminated, dried at 20 degree centigrade and 60 % relative humidity, the dried powder scraped off and its absorptiveness measured.

(2) Bekk smoothness.

The smoothness of base paper and coated paper is measured according to JIS P8119.

(3) Surface strength of coating layer.

10 Evaluated by the blanket scum on the high speed web-fed offset press (Koebau BB* type by Sumitomo Heavy Industry Co., Ltd.) after a 1000 m printing run at a printing speed of 500 m/min.

The standard level of the blanket^{et} scum is that of usual newsprint at the same conditions. The level is evaluated as good (less blanket scum than standard), fair (same level blanket scum comparing to standard), and poor (more blanket scum than standard).

(4) Setting of ink.

20 Just after the printing run at the conditions described in (3) above, three sheets at about 500 m from the starting point are collected, covered with fine paper sheets and kept under a pressure of 50 g/cm^2 for 1 hour. The degree of set-off on the surface of the fine paper is then evaluated by eye.

The standard level of the set-off is that of usual newsprint. The level is evaluated as good (less set-off than standard), fair (same level set-off to standard), and poor (more set-off than standard).

*Trade Mark

(5) Ink density.

Solid density of the printing test pattern is measured with Macbeth densitometer (made by Kollmogen Corporation). The sufficient level is more than 1.30, and the level is poor if the readings are less than 1.20.

(6) Brightness.

The brightness of sheets is measured with Hunter brightness tester (made by Toyo Seiki Co., Ltd.).

(7) Gloss.

10 The sheet gloss and the print gloss are measured with 75 degree glossmeter (made by Murakami Shikisai Kenkyusyo).

(8) Reproducibility of dots.

Evaluate size, shape and condition of overlapping of dots by eye with a magnifying glass. The reproducibility level of usual newsprint is poor, the level better than that of newsprint is considered fair. When the copy is almost perfectly reproduced on the sample, the level is considered good.

20 Sharp and good color reproducibility can be obtained and the printed sheet has strong impact when the ink density is high, the reproducibility of dots is good, and the brightness of the sheet is high.

(9) Rub-off of ink.

Just after the printing, the surface of the printed part is softly rubbed with fingers and the level of the ink rubbed off is evaluated. The level of usual newsprint is considered good. The level of contamination greater than that is considered

fair. Still greater level of contamination is considered poor. The poor level is not admissible in the commercial printing.

In the examples and comparative examples below, parts represent solid weight parts and percent (%) represents weight percent.

Comparative Example 1.

10

50 parts of ground wood pulp, 30 parts of recycled pulp from deinked newspaper, and 20 parts of kraft pulp were mixed and refined to the Canadian standard freeness of 200 ml. With the mixed and refined pulp described above, the base paper A was produced on a Bel-Baie former type paper machine at the speed of 960 m/min. The base weight, brightness, smoothness and density of the base paper was 46 g/m², 51 %, 60 sec, and 0.65, respectively, and these values were at standard level of usual newsprint.

Example 1

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30 parts of satin white (SW-BL* by Shiraisi Karusyumu Co. Ltd., oil absorptiveness 100 cc/100 g), 40 parts of calcined clay (oil absorptiveness 90 cc/100 g), and 30 parts of No.2 clay (oil absorptiveness 45 cc/100 g) were added to water containing a dispersant (Aron T-40* by Toagousei Co. Ltd., 40% concentration), then pigment slurry was prepared by mixing with agitation. The oil absorptiveness of the mixed pigment described above was 80 cc/100 g.

Then, 25 parts of styrene butadiene latex and 15 parts of oxidized starch were added to the slurry with agitation, mixed well, and a 45% coating color was prepared.

*Trade Mark

This coating color was applied to both sides of the base paper A on a blade coater to produce newsprint B1. The coat weight for the each side of newsprint B1 was 5 g/m^2 (oven dry), a total of 10 g/m^2 for the both sides. Bekk smoothness of the coating layer was 45 sec.

This paper was supercalendered on a supercalender (by Ishikawazima Heavy Industry Co., Ltd.) at 60 degree centigrade at the line pressure of 100 kg/cm to produce newsprint C1. Bekk smoothness of newsprint C1 was 100 sec.

10 Printing was performed on these papers using a high speed web-fed press (Koebau BB* type by Sumitomo Heavy Industry Co., Ltd.) at a printing speed of 500 m/min. Cold-set inks of cyan and magenta for newsprint (Newswebmaster*, Purosesubeni M*, Purosesuai M* by Sakata Syokai) were used for the printing.

The results of handling and printing quality are shown in Table 1.

Example 2.

20 A needle form precipitated calcium carbonate was used as a needle form pigment. A 30% pigment slurry was prepared using a formulation described below by the procedure described in Example 1. Prepared coating color was applied on an air knife coater on the base paper A produced in comparative Example 1 to produce newsprint B2. The coat weight for each side was 5 g/m^2 .

Calcined clay	50 parts
(oil absorptiveness 95 cc/100 g)	

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Synthetic Silica	10 parts
(oil absorptiveness 290 cc/100 g)	
Needle form precipitated calcium carbonate	20 parts
(oil absorptiveness 53 cc/100 g)	
Super fine ground calcium carbonate	20 parts
(oil absorptiveness 30 cc/100 g)	
Dispersant (sodium pyrophosphate)	0.5 parts
Styrene butadiene latex	15 parts
Polyvinyl alcohol	10 parts

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The oil absorptiveness of the mixed pigments was 95 cc/100 g. The smoothness of the coating layer was 42 sec. Newsprint B2 was subsequently supercalendered to produce newsprint C2 having the smoothness of 110 sec. Printing test was performed with these newsprints. The results are also shown in Table 1. Example 3.

20

Satin white was used as a needle form pigment. The formulation of Example 1 was modified as described below, and 45% slurry was used. Newsprint B3, having the smoothness of 43 sec, was produced in the manner described in Example 1. Newsprint C3, having the smoothness of 120 sec, was then produced by supercalendering. The results of the printing test are shown in Table 1.

Satin white	10 parts
(SW-BL* by Shiraishi Karusyumu Co., Ltd.,	
(oil absorptiveness 100 cc/100 g)	
No. 2 Kaolin	15 parts
Calcined clay	75 parts

*Trade Mark

Styrene butadiene latex	5 parts
Oxidized starch	6 parts
Dispersant	0.5 parts

The oil absorptiveness of No. 2 kaolin and calcined clay were 42 cc/100 g and 90 cc/100 g, respectively, and that of the mixed pigments was 85 cc/100 g.

Comparative Example 2.

10 A 35% pigment slurry was prepared using a formulation described below in the manner described in Example 1. The coating color was applied with an air knife coater on the newsprint A produced in Comparative Example 1. The coat weight for each side was 5 g/m², and newsprint B4, having the smoothness of 42 sec, was produced.

Calcined clay	80 parts
Super fine ground calcium carbonate	20 parts
Dispersants (Sodium pyrophosphate)	0.5 parts
Styrene butadiene latex	10 parts
Polyvinyl alcohol	10 parts

20 The oil absorptiveness of calcined clay and super fine ground calcium carbonate were 95 cc/100 g and 30 cc/100 g, respectively. That of the mixed pigments was 75 cc/100 g.

A newsprint having smoothness of 100 sec, was produced by supercalendering. The results of printing are shown in Table 1.

	Papers	Parts of Needle form pigments (weight %)	Oil absorptiveness (cc/100 g)	Smoothness (sec)	Surface Strength	Setting of ink
Comparative Example	Base Paper A			60	good	good
	B4	0	75	42	good	good
Example	B3	10	85	43	good	good
	B2	20	95	42	good	good
	B1	30	80	45	good	good
	C4	0	75	100	good	good
Comparative Example	C3	10	85	120	good	good
	C2	20	95	110	good	good
Example	C1	30	80	100	good	good

	Brightness (%)	Print Gloss (%)	Ink density	Reproducibility of dots	Rub-off
Comparative Example	50.7	10	1.10	poor	good
	64.9	13	1.28	good	good
Example	65.1	20	1.33	good	good
	65.3	21	1.34	good	good
	64.8	23	1.36	good	good
Comparative Example	64.4	31	1.31	good	good
Example	64.9	40	1.37	good	good
	65.0	42	1.38	good	good
	64.6	44	1.41	good	good

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10 As shown in Table 1, it is apparent that the brightness and the print gloss of newsprint A were at a lower level, and its reproducibility of color was not satisfactory because of its poor reproducibility of dots. Accordingly, newsprint A was not suitable for the commercial multicolor printing. Newsprints which had a coating layer including needle form pigments showed higher print gloss regardless of their smoothness than coated papers B4 and C4, whose coating layer did not include the needle form pigments and whose oil absorptiveness was 75 cc/100 g, as described in comparative Example 2. Additionally, newsprints in Examples showed excellent surface strength, setting of ink, brightness, ink density, reproducibility of dots, and rub-off, and were suitable for the high speed multicolor printing on high speed web-fed press using cold-set ink.

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CLAIMS:

1. A newsprint for a newspaper press using cold-set ink, which newsprint comprises:

a base stock composed mainly of mechanical pulp; and

5 a coating layer coated on the base stock in an amount of 1 to 12 g/m², containing a pigment composition comprising a needle form pigment selected from the group consisting of satin white and needle form precipitated calcium carbonate, in an amount of more than 20% by weight based on the total amount of
10 pigment in the pigment composition, wherein the pigment composition has an average oil absorptiveness of more than 65 cc / 100 g.

2. A newsprint according to claim 1, wherein the average oil absorptiveness of the pigment composition is from 75 cc /
15 100 g to 150 cc / 100 g.

3. A newsprint according to claim 1 or 2, wherein the mechanical pulp is at least one pulp selected from the group consisting of ground wood pulp, thermomechanical pulp, semichemical pulp, and recycled mechanical pulps produced by
20 deinking of newspapers or magazines containing these pulps.

4. A newsprint according to claim 1, 2, or 3, wherein the needle form pigment has a length to width ratio of at least 3 to 1.

5. A newsprint according to claim 4, wherein the needle
25 form pigment has a length to the width ratio of at least 5 to 1.

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6. A newsprint according to any one of claims 1 to 5, wherein the needle form pigment is used in an amount of at least 30 weight percent based on the total amount of pigment in the pigment composition.
- 5 7. A newsprint according to anyone of claims 1 to 6, wherein the pigment composition further comprises a pigment selected from the group consisting of silicon dioxide, activated clay, fine magnesium carbonate, silicates, diatomaceous earth, urea resin powder, kaolin, talc, calcium
10 carbonate, titanium dioxide, zinc white, and mixtures thereof.
8. A newsprint according to any one of claims 1 to 7, wherein at least 15% of pigments in the pigments composition have an oil absorptiveness greater than 65 cc / 100 g.
9. A newsprint according to claim 8, wherein at least
15 20% of pigments in the pigment composition have an oil absorptiveness greater than 65 cc / 100 g.
10. A newsprint according to any one of claims 1 to 9, wherein the coating layer is coated on the base stock in an amount of from 3 to 8 g/m².
- 20 11. A newsprint according to any one of claims 1 to 10, wherein one side of the base stock is coated with the coating layer.
12. A newsprint according to any one of claims 1 to 10, wherein both sides of the base stock are coated with the
25 coating layer.
13. A newsprint according to any one of claims 1 to 12, wherein the newsprint has a total basis weight including the base stock of less than 60 g/m².

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14. A newsprint according to claim 13, wherein the total basis weight is from 40 to 52 g/cm².

15. A newsprint for a newspaper press using a cold-set ink, which comprises:

5 a base stock composed mainly of mechanical pulp; and

a coating layer coated on one or both sides of the base stock each in an amount of 1 to 12 g/m², provided that a total basis weight of the base stock and the coating layer is less than 60 g/m²,

10 wherein the coating layer comprises a binder and a pigment composition comprising:

(a) at least one high oil absorptiveness pigment having an oil absorptiveness of more than 65 cc / 100 g selected from the group consisting of silicon dioxide, 15 activated clay, calcined clay, fine magnesium carbonate, silicates, diatomaceous earth, urea resin powder and satin white; and

(b) at least one low oil absorptiveness pigment having an oil absorptiveness of less than 65 cc / 100 g 20 selected from the group consisting of kaolin, talc, calcium carbonate, zinc white and clay;

wherein the pigment composition has an average oil absorptiveness of more than 65 cc / 100 g and not more than 150 cc / 100 g; and

25 wherein the pigment composition contains at least 10% by weight (based on the pigment composition) of a needle form pigment having a length to width ratio of at least 3 and being

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selected from the group consisting of satin white and precipitated calcium carbonate.

16. A newsprint according to claim 15, wherein the pigment composition contains at least 20% by weight of the
5 needle form pigment.

17. A newsprint according to claim 15, wherein the pigment composition contains at least 30% by weight of needle
form pigment.

18. A method for multi-coloured newsprinting using a high
10 speed press and penetration-type cold-set ink, comprising printing on a high-speed press a newsprint according to any one of claims 1 to 17 with a penetration-type cold-set ink.

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