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(54) **LIQUID PACKAGING PAPER**

(57) A Kraft paper having a grammage of 65-85 g/m² according to ISO 536, wherein the Bendtsen roughness of at least one side of the paper is below 300 ml/min according to ISO 8791-2 and the geometric bending resistance of the paper according to ISO 2493-1 divided

by the thickness of the paper according to ISO 534 is at least 0.65 mN/μm, preferably at least 0.72 mN/μm, such as at least 0.78 mN/μm, wherein the geometric bending resistance is measured using a bending angle of 15° and a test span length of 10 mm.

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Description**TECHNICAL FIELD**

5 **[0001]** The invention relates to paper for liquid packaging.

BACKGROUND

10 **[0002]** In the field of liquid packaging, paperboard is the most common cellulosic fiber based material. However, for some types of liquid packages, paper is used instead of paperboard as the carrier.

[0003] Liquid packages based on paper are common in emerging markets, such as China and India. A common liquid packaging product is a pillow-shaped pouch. The paper used as the carrying medium for pillow pouches often has a high strength in relation to its thickness, which has been considered important due to rough handling during transporting and to prevent rupture if the pouches are dropped. Paperboard generally has higher strength than paper, but cannot be
15 used because it is not flexible enough (too stiff) for the converting process forming the pillow pouches. Further, paperboard, which typically has at least two times higher grammage than the paper used for the pillow pouch application, is not a cost-effective option.

[0004] The paper grades conventionally used for the pillow pouch application are for reasons of strength and purity typically produced using a strong bleached softwood Kraft pulp (NSBK) that has been refined using high consistency refining followed by intensive low consistency refining. Further, such paper grades are normally produced on a multi-cylinder Kraft paper machine that is integrated with the pulp mill, which means only never-dried pulp is used.
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SUMMARY

25 **[0005]** The inventor has realized that one drawback of the above-mentioned paper grades conventionally used for the pillow pouch application is that the surface roughness of the printing side is too high, which means that some printing requirements cannot be met. Further, the inventor has realized that the pouches resulting from the conventional paper grades often are too floppy/flabby and can be difficult to handle. For example, it may be difficult to open and/or pour from the prior art pouches without spilling.

30 **[0006]** To solve the problems of the prior art, the present disclosure presents a Kraft paper that, without an increased thickness, has decreased surface roughness (improving printability) and increased bending resistance (reducing floppiness/flabbiness). A key factor in producing the Kraft paper of the present disclosure is the use of a machine glaze (MG) cylinder or a Yankee cylinder (YC) in the drying.

[0007] The following is an itemized listing of embodiments of the present disclosure.
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1. A Kraft paper having a grammage of 65-85 g/m² according to ISO 536, wherein the Bendtsen roughness of at least one side of the paper is below 300 ml/min according to ISO 8791-2 and the geometric bending resistance of the paper according to ISO 2493-1 divided by the thickness of the paper according to ISO 534 is at least 0.65 mN/μm, preferably at least 0.72 mN/μm, such as at least 0.78 mN/μm.
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2. The Kraft paper of item 1, which is bleached.

3. The bleached Kraft paper according to item 2, wherein the brightness according to ISO 2470-1 is at least 70 %, such as at least 75 %, such as 75-100 %.
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4. The Kraft paper according to any one of the preceding items, which comprises inorganic filler, such as clay, in such an amount that the ash content of the Kraft paper is 1-7 %, such as 2-6 %, according to ISO 2144.

5. The Kraft paper according to any one of the preceding items, wherein the bending resistance in the machine direction (MD) of the paper according to ISO 2493-1 divided by the thickness of the paper according to ISO 534 is at least 0.90 mN/μm.
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6. The Kraft paper according to any one of the preceding items, wherein the bending resistance in the cross direction (CD) of the paper according to ISO 2493-1 divided by the thickness of the paper according to ISO 534 is at least 0.50 mN/μm.
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7. The Kraft paper according to any one of the preceding items, wherein the stretchability in the cross direction (CD) is 2-5 % according to ISO 1924-3.

8. The Kraft paper according to any one of the preceding items, wherein the Bendtsen roughness according to ISO 8791-2 of at least one side of the paper is below 250 ml/min, such as below 200 ml/min, such as below 150 ml/min, such as below 100 ml/min, such as below 70 ml/min.

9. The Kraft paper according to any one of the preceding items, which comprises at least one hydrophobic size.

10. The Kraft paper according to item 9, which comprises alum and wherein the at least one hydrophobic size comprises rosin size.

11. The Kraft paper according to any one of the preceding items, which comprises starch.

12. A multilayer material comprising:

a paper layer having a printing side and a backside, which paper layer is the Kraft paper according to any one of the preceding items;
a first coating layer provided on the printing side; and
a second coating layer provided on the backside.

13. The multilayer material according to item 12, wherein the geometric bending resistance of the multilayer material according to ISO 2493-1 divided by the thickness of the multilayer material according to ISO 534 is at least 1.20 mN/ μ m, preferably at least 1.30 mN/ μ m.

14. The multilayer material according to item 12 or 13, wherein the grammage of the multilayer material is 135-175 g/m² according to ISO 536.

15. The multilayer material according to any one of items 12-14, wherein the coat weight of the first coating layer is 5-25 g/m², such as 9-18 g/m².

16. The multilayer material according to any one of items 12-15, wherein the first coating layer comprises polyethylene or polypropylene.

17. The multilayer material according to any one of items 12-16, wherein the second coating layer comprises polyethylene or polypropylene.

18. The multilayer material according to any one of items 12-17, wherein the second coating layer comprises a gas barrier sublayer, such as a sublayer of EVOH, polyamide or aluminium.

19. The multilayer according to item 18, wherein the gas barrier sublayer is sandwiched between two plastic sublayers, such as two sublayers of polyethylene or polypropylene.

20. The multilayer material according to item 19, wherein each of the plastic sublayers has a coat weight of 5-25 g/m², such as 9-18 g/m².

21. A pillow pouch composed of the multilayer material according to any one of items 12-20.

22. The pillow pouch according to item 21 having a volume of 50-1200 ml, such as 70-1000 ml, such as 100-500 ml.

23. The pillow pouch according to item 21 or 22, which is filled with a liquid.

24. A method of producing the Kraft paper according to any one of items 1-11, comprising:

a) providing a furnish of softwood Kraft pulp or a mixture of softwood Kraft pulp and hardwood pulp;
b) diluting the furnish prior to a head box and then forming and dewatering a paper web in a wire section, such as a fourdriner wire section, which may be equipped with a hybrid former for improved dewatering;
c) wet pressing the paper web from step b) in a press section, which preferably comprises several press nips;
d) pre-drying the paper web from step c); and
e) further drying the pre-dried paper web from step d) using a machine glaze (MG) cylinder or a Yankee cylinder (YC).

25. The method according to item 24, further comprising the step of:

f) calendering the dried paper from step e) such that a printing side of the resulting paper has a Bendtsen roughness according to ISO 8791-2 below 100 ml/min, such as below 70 ml/min.

26. The method according to item 24 or 25, wherein the furnish provided in step a) is composed of never-dried pulp.

27. The method according to any one of items 24-26, wherein the softwood Kraft pulp and the hardwood pulp are bleached.

28. The method according to any one of items 24-27, further comprising bleaching unbleached pulp with chlorine dioxide and hydrogen peroxide to obtain the furnish provided in step a).

29. The method according to any one of items 24-28, wherein:

softwood pulp constitutes 50-100 %, such as 55-70 %, of the dry weight of the furnish provided in step a); and hardwood pulp constitutes 0-50 %, such as 30-45 %, of the dry weight of the furnish provided in step a).

30. The method according to any one of items 24-29, wherein at least one hydrophobic size is added to the furnish, preferably before the dilution of step b).

31. The method according to item 30, wherein the at least one hydrophobic size comprises rosin size and wherein alum is added to the furnish.

32. The method according to item 31, wherein the total amount of rosin size added to the furnish is 1-8 kg/ton dry fiber, such as 3-8 kg/ton dry fiber.

33. The method according to any one of items 24-32, wherein starch is added to the furnish, preferably before the dilution of step b).

34. The method according to item 33, wherein the total amount of starch added to the furnish is 3-9 kg/ton dry fiber, such as 4-8 kg/ton dry fiber.

35. The method according to any one of items 24-34, wherein inorganic filler, such as clay, is added to the furnish.

36. The method according to item 35, wherein the total amount of inorganic filler added to the furnish is 10-50 kg/ton dry fiber, preferably 25-45 kg/ton dry fiber.

DETAILED DESCRIPTION

[0008] As a first aspect of the present disclosure, there is provided a Kraft paper having a grammage of 65-85 g/m² according to ISO 536. Preferably, the grammage is 70-85 g/m², such as 70-80 g/m². A typical grammage for the pillow pouch application is 75 g/m².

[0009] The Kraft paper of the present disclosure is prepared from a furnish comprising at least 50 % (by dry weight) Kraft pulp. Preferably, the furnish comprises at least 75 % (by dry weight), such as at least 90 % (by dry weight), Kraft pulp. The Kraft paper of the present disclosure is preferably produced from 100 % Kraft pulp. Kraft paper provides the strength that is needed for the pillow application.

[0010] The Bendtsen roughness of at least one side of the paper is below 300 ml/min according to ISO 8791-2. Preferably, it is below 250 ml/min, such as below 200 ml/min. Such a roughness may be obtained by using a MG cylinder or a Yankee cylinder as further discussed below. In embodiments of the first aspect, the roughness in question is below 150 ml/min, preferably below 100 ml/min, more preferably below 70 ml/min. Roughness values below 150 ml/min may be obtained by also calendering the paper, as further discussed below.

[0011] The side of the paper having the lowest surface roughness is normally referred to as the printing side. The printing side is also the side of the paper that contacts the MG cylinder or Yankee cylinder.

[0012] The paper of the first aspect is further defined by a quotient obtained by dividing the geometric bending resistance of the paper (measured according to ISO 2493) by the thickness of the paper (measured according to ISO 534). The quotient is at least 0.65 mN/μm. It is preferably at least 0.72 mN/μm, more preferably at least 0.78 mN/μm. This means that the bending stiffness of the present disclosure does not come at the expense of a higher thickness.

[0013] Normally, the bending resistance of the Kraft paper of the first aspect is higher in the machine direction (MD) than in the cross direction (CD). The bending resistance (ISO 2493-1) of the paper of the first aspect is typically 90-120 mN in the MD and 50-75 mN in the CD. To take the bending resistance (BR) in both MD and CD into account, the geometric BR is calculated as the square root of the product of BR in MD and BR in CD ($BR(\text{geometric}) = \sqrt{BR(\text{MD}) * BR(\text{CD})}$). The geometric bending resistance of the paper of the first aspect is typically 65-90 mN.

[0014] When the bending resistance of the present disclosure is tested according to ISO 2493-1, a bending angle of 15° and a test span length of 10 mm are used.

[0015] The thickness (ISO 534) of the paper of the first aspect is typically 85-105 μm, such as 90-100 μm.

[0016] In the first aspect, the bending resistance in the machine direction (MD) of the paper according to ISO 2493-1 divided by the thickness of the paper according to ISO 534 may for example be at least 0.90 mN/μm, such as at least 1.00 mN/μm. Further, the bending resistance in the cross direction (CD) of the paper according to ISO 2493-1 divided by the thickness of the paper according to ISO 534 may for example be at least 0.50 mN/μm, such as at least 0.60 mN/μm.

[0017] The geometric bending resistance index of the paper of the first aspect may for example be at least 180 Nm⁷/kg³

[0018] The Kraft paper of the first aspect typically has a lower stretchability in the cross direction (CD) than a Kraft paper produced on a multi-cylinder Kraft paper machine. For example, the latter Kraft paper typically has a stretchability in the CD of about 8 %, whereas the Kraft paper of the first aspect may have a stretchability in the CD of 2-5 %. Stretchability is preferably measured according to ISO 1924-3.

[0019] The Kraft paper of the first aspect is relatively strong. For example, the tensile strength may be at least 6 kN/m, such as 6-10 kN/m, in the machine direction (MD). In the cross direction (CD), the tensile strength may be at least 3 kN/m, such as at least 3.5 kN/m, such as 3.5-5.5 kN/m.

[0020] In order to increase the dry paper strength and improve retention (e.g. of fines, fillers and/or other chemicals), the paper of the first aspect may comprise a dry strength agent, such as starch. The dry strength agent may for example be cationic. Examples of cationic dry strength agents are cationic starch and cationic polyacrylamide (C-PAM). When the paper comprises a cationic strength agent, it may also comprise an anionic microparticle, such as silica. Cationic starch and silica is a preferred combination.

[0021] To improve printability and decrease the fiber consumption, the Kraft paper of the first aspect may comprise inorganic filler, such as clay. For example, the amount of inorganic filler may be 1-7 g/m², such as 3-6 g/m². It follows that the Kraft paper of the first aspect may have a substantial ash content, such as an ash content of 1-7 %, preferably 2-6 %, according to ISO 2144. If the amount of inorganic filler is too high, the strength of the paper may be insufficient.

[0022] The inclusion of an inorganic filler, such as clay increases the opacity of the Kraft paper of the first aspect. For example, the opacity according to ISO 2471 of the Kraft paper of the first aspect may be at least 70 %, such as at least 75 %.

[0023] The Kraft paper of the first aspect is preferably bleached. Accordingly, it may have a brightness according to ISO 2470-1 of at least 70 %, such as 70-100 %. Preferably, the brightness according to ISO 2470-1 is at least 75 %, such as 75-100 %.

[0024] To improve the resistance against edge penetration (edge-wicking), the Kraft paper according to the first aspect may comprise hydrophobic size.

[0025] Examples of hydrophobic size are rosin size, alkylketene dimer (AKD) size and alkyl succinic anhydride (ASA) size.

[0026] When rosin size is added to the paper, it is preferred to also add alum.

[0027] In a preferred embodiment, the Kraft paper of the first aspect comprises AKD, rosin size and alum.

[0028] Suitable amounts of AKD, rosin size and alum are discussed below.

[0029] As a second aspect of the present disclosure, there is provided a multilayer material comprising:

a paper layer having a printing side and a backside, which paper layer is a Kraft paper according to the first aspect;
a first coating layer provided on the printing side; and
a second coating layer provided on the backside.

[0030] The multilayer material of the second aspect is primarily intended for the formation of pillow pouches, e.g. for liquids.

[0031] The printing side is typically printed, which means that the first coating layer covers the printed printing side. In such case, the first coating layer is preferably transparent. Many plastic coatings, such as PE or PP coatings (discussed below), are transparent. Alternatively, the first coating layer may be printed.

[0032] When the coating layers are applied, the thickness and the bending resistance increase. For the multilayer material of the second aspect, the quotient obtained by dividing the geometric bending resistance (measured according to ISO 2493) by the thickness (measured according to ISO 534) may be at least 1.22 mN/μm, preferably at least 1.30 mN/μm.

[0033] The coating layers also increase the grammage, which may be 135-175 g/m² (measured according to ISO 536) for the multilayer material of the second aspect.

[0034] The coat weight of the first coating layer may for example be 5-25 g/m², such as 9-18 g/m². The first coating layer may comprise polyethylene (PE) or polypropylene (PP).

[0035] The first and/or the second coating layer may comprise sublayers. For example, the second coating layer may comprise a gas barrier sublayer. The gas barrier sublayer may for example be composed of EVOH, polyamide or aluminium. Such an aluminium sublayer is often referred to as an aluminium foil, which may have a thickness of 5-10 μm, such as 6-8 μm.

[0036] The gas barrier sublayer may be sandwiched between two plastic sublayers, such as two sublayers of PE or PP. In such case, the second coating layer comprises at least three sublayers. Each of the plastic sublayers may for example have a coat weight of 5-25 g/m², such as 9-18 g/m².

[0037] The multilayer material of the second aspect may be referred to as a laminate.

[0038] As a third aspect of the present disclosure, there is provided a pillow pouch composed of a multilayer material according to the second aspect.

[0039] The pillow pouch normally has a longitudinal seal adhering two overlapping ends of the paper material to each other to form a lap seal. Alternatively, the longitudinal seal may be a fin seal. Further, the pillow pouch normally has a first end sealed by a fin seal and a second end sealed by a fin seal.

[0040] The pillow pouch of the third aspect typically has a volume of 50-1200 ml. A preferred volume is 70-1000 ml, such as 100-500 ml.

[0041] The pillow pouch of the third aspect may be filled with a liquid, preferably a liquid for drinking.

[0042] The pillow pouch of the third aspect is typically produced by unwinding multilayer material according to the second aspect from a reel followed by sterilization (e.g. by treatment with hydrogen peroxide) of the material. The sterilized material is then formed into a tube, which is filled with a liquid. Finally, sealing and cutting into individual packages containing the liquid is performed.

[0043] As a fourth aspect of the present disclosure, there is provided a method of producing a Kraft paper according to the first aspect.

[0044] The method of the fourth aspect comprises:

- a) providing a furnish of softwood Kraft pulp or a mixture of softwood Kraft pulp and hardwood pulp;
- b) diluting the furnish prior to a head box and then forming and dewatering a paper web in a wire section, such as a fourdriner wire section, which may be equipped with a hybrid former for improved dewatering;
- c) wet pressing the paper web from step b) in a press section, which preferably comprises several press nips;
- d) pre-drying the paper web from step c); and
- e) further drying the pre-dried paper web from step d) using a machine glaze (MG) cylinder or a Yankee cylinder (YC).

[0045] The furnish provided in step a) is preferably composed of never-dried pulp. The hardwood pulp that may form part of the furnish provided in step a) is preferably hardwood Kraft pulp.

[0046] The pulp(s) of the furnish provided in step a) is/are preferably bleached. The method of the fourth aspect may comprise the step(s) of bleaching the pulp(s). The bleaching step(s) may comprise treatment with chlorine dioxide and hydrogen peroxide, which results in fibers that do not give the packaged liquid an unwanted taste or odour.

[0047] In one embodiment of the fourth aspect, the fibers of the furnish are refined. Refining may be carried out to the extent that a Schopper Riegler (SR) value of 23-30, such as 24-28, measured according to ISO 5267-1 is obtained. If the furnish is composed of two pulps, the pulps may be co-refined or refined separately.

[0048] In an embodiment of the fourth aspect, softwood Kraft pulp constitutes 50-100 %, such as 55-90 % or 55-70 %, of the dry weight of the furnish provided in step a) and hardwood pulp, such as hardwood Kraft pulp, constitutes 0-50 %, such as 10-45 % or 30-45 %, of the dry weight of the furnish provided in step a).

[0049] In a preferred embodiment, never-dried bleached softwood Kraft pulp constitutes 55-70 % and never-dried bleached hardwood Kraft pulp constitutes 30-45 % of the dry weight of the furnish provided in step a).

[0050] An effect of including hardwood pulp is that a smoother printing side is obtained.

[0051] Hydrophobic size, such as rosin size, AKD and/or ASA, can be added to the furnish. If rosin size is added, it is preferred to also add alum. The weight ratio of rosin size to alum may be between 1.5:1 and 1:1.5. The point(s) of addition for the hydrophobic size and the alum is/are preferably upstream the dilution of step b).

[0052] The total amount of rosin size added to the furnish may for example be 1-8 kg/ton dry fiber, such as 3-8 kg/ton dry fiber.

[0053] In an embodiment, rosin size is added to the furnish in a total amount of 2-5 kg/ton dry fiber and AKD is added to the furnish in a total amount of 0.1-1 kg/ton dry fiber, such as 0.2-0.7 kg/ton dry fiber.

[0054] Further, at least one strength agent, such as starch, may be added to the furnish, preferably before the dilution of step b).

[0055] As discussed above, the dry strength agent may for example be cationic and examples of cationic dry strength agents are cationic starch and cationic polyacrylamide (C-PAM). When the method comprises addition of a cationic

strength agent, it may also comprise addition of an anionic microparticle, such as silica. It is preferred to add both cationic starch and silica to the furnish before the dilution of step b).

[0056] The total amount of starch, such as cationic starch, added to the furnish may for example be 3-9 kg/ton dry fiber, such as 4-8 kg/ton dry fiber. The total amount of anionic microparticle may for example be 0.05-0.50 kg/ton dry fiber.

[0057] Inorganic filler may be added to the furnish, preferably before the dilution of step b). A preferred example of inorganic filler is clay.

[0058] The total amount of inorganic filler added to the furnish may for example be 10-50 kg/ton dry fiber, preferably 25-45 kg/ton dry fiber.

[0059] In embodiments of the fourth aspect, the method further comprises the step of:

f) calendering the dried paper from step e) such that a printing side of the resulting paper has a Bendtsen roughness according to ISO 8791-2 below 100 ml/min, such as below 70 ml/min.

[0060] The calender used for step f) may be of soft nip, hard nip or long-nip belt type.

[0061] As a fifth aspect of the present disclosure, there is provided a method of preparing a multilayer material according to the second aspect, comprising the steps of:

i) providing a Kraft paper according to the first aspect or preparing a Kraft paper according to the fourth aspect; and

ii) applying the first coating layer on the printing side of the Kraft paper and applying the second coating layer on the backside of the Kraft paper.

[0062] Printing on the printing side of the Kraft paper is preferably carried out between steps i) and ii). Alternatively, it can be carried out after step ii).

[0063] Step ii) is sometimes referred to as lamination.

EXAMPLE

[0064] A furnish composed of 60 % (by dry weight) never-dried bleached softwood Kraft pulp and 40 % (by dry weight) never-dried bleached hardwood Kraft pulp was prepared. The furnish was refined at a consistency of 3.5 % using three refiners arranged in series. The energy supply was 35 kWh/ton dry pulp in the first refiner, 35 kWh/ton dry pulp in the second refiner and 40 kWh/ton dry pulp in the third refiner. After the third refiner, the Schopper Riegler (SR) value of the furnish was 26 according to ISO 5267-1.

[0065] Then, alum in an amount of 5.5 kg/ton dry fiber and rosin size in an amount of 5.5 kg/ton dry fiber were added at a pH of 5.5 (ISO 6588-1). Further, cationic starch was added in an amount of 6 kg/ton together with 0.15 kg/ton dry fiber of silica (Eka NP 442). The chemicals were added to the thick stock, i.e. prior to the dilution of the furnish and thus prior to the head box. Clay (Capim CC, Imerys) in an amount 35 kg/ton dry fiber was also added to the furnish prior to the dilution.

[0066] The furnish was then diluted prior to the head box. A paper web was formed and dewatered on a fourdriner wire section.

[0067] After the wire section, the dry matter content of the web was increased from about 20% to about 35 % in a press section. After wet pressing in the press section, the paper was pre-dried before entering an MG cylinder for final drying. An advantage of MG cylinder drying compared to multi-cylinder drying is that the printing side of the paper is adhered to the surface of the MG cylinder and thereby restrained during final drying. Thereby, the resulting paper has a high tensile stiffness, a low strain at break and a smoother surface compared to paper produced with unrestrained drying (e.g. multi-cylinder drying).

[0068] Properties of the resulting paper ("MG Kraft paper") were measured and compared to a reference paper ("Multi-cylinder-dried Kraft paper") representing the prior art (see Table 1).

Table 1.

Property	Unit	MG Kraft paper	Multi-cylinder-dried Kraft paper
Grammage	g/m ²	75	72
Pulp Fibers	g/m ²	~71	72
Clay	g/m ²	~3.5	
Moisture	%	5.5	7.5

(continued)

Property	Unit	MG Kraft paper	Multi-cylinder-dried Kraft paper
Thickness	μm	95	104
Gurley air resistance	S	30	62
Tensile Strength, MD	kN/m	8.2	8.1
Tensile Strength, CD	kN/m	4.1	4.7
Strain, MD	%	1.7	2.4
Strain, CD	%	3.3	8.0
TEA, MD	J/m ²	94	125
TEA, CD	J/m ²	98	250
Tear Strength, MD	mN	620	767
Tear Strength, CD	mN	721	724
Bending resistance, MD	mN	106.5	86
Bending resistance, CD	mN	58.5	40.5
Bending resistance, Geo	mN	79	59
Bending resistance Index, Geo	Nm ⁷ /kg ³	189	172
Quotient#	mN/ μm	0.83	0.57
Roughness, PS*	ml/min	151	639
Roughness, BS**	ml/min	746	1018
Cobb, PS	g/m ²	24	
Wick index HP	kg/m ²	0.4	0.4
Brightness	ISO %	80	81
Opacity		80 %	67 %
Formation	g/m ²	5.7	5.7
Ash Content	%	3.9	O
# Geometric bending resistance divided by thickness * Printing side, ** Backside			

[0069] Table 1 shows that the bending resistance in both MD and CD is higher for the MG Kraft paper than for the prior art Kraft paper even though the MG Kraft paper has a lower amount of fibers and is thinner than the prior art Kraft paper. Table 1 further shows that the tensile strength values of the MG Kraft paper are satisfactory despite the addition of clay. The most striking difference between the MG Kraft paper and the prior art Kraft paper is the roughness of the printing side, which is above 600 ml/min for the prior art Kraft paper, but only about 150 ml/min for the MG Kraft paper.

[0070] Multilayer materials were prepared by laminating the MG Kraft paper and the prior art Kraft paper, respectively, with a first coating on the printing side and a second coating on the backside. The first coating was a 12 g/m² PE film. The second coating was an aluminum foil sandwiched between two sublayers of 12 g/m² PE film.

[0071] Properties of the multilayer materials were measured (see table 2).

Table 2.

Property	Unit	Multilayer, MG Kraft paper	Multilayer, Multi-cylinder-dried Kraft paper
Grammage	g/m ²	153	152
Thickness	μm	156	157
Tensile Strength, MD	kN/m	9.8	9.5

(continued)

Property	Unit	Multilayer, MG Kraft paper	Multilayer, Multi-cylinder-dried Kraft paper
Tensile Strength, CD	kN/m	5.4	4.8
Strain, MD	%	2.1	2.7
Strain, CD	%	3.6	~8.5
TEA, MD	J/m ²	132	169
TEA, CD	J/m ²	139	389
Bending resistance, MD	mN	253	223
Bending resistance, CD	mN	188	158
Bending Resistance, Geo	mN	218	188
Quotient#	mN/ μ m	1.40	1.20
# Geometric bending resistance divided by thickness			

[0072] Table 2 shows that the bending resistance in both MD and CD is higher for the multilayer material of the MG Kraft paper than for the prior art multilayer material even though the former is thinner.

Claims

1. A Kraft paper having a grammage of 65-85 g/m² according to ISO 536, wherein the Bendtsen roughness of at least one side of the paper is below 300 ml/min according to ISO 8791-2 and the geometric bending resistance of the paper according to ISO 2493-1 divided by the thickness of the paper according to ISO 534 is at least 0.65 mN/ μ m, preferably at least 0.72 mN/ μ m, such as at least 0.78 mN/ μ m, wherein the geometric bending resistance is measured using a bending angle of 15° and a test span length of 10 mm.
2. The Kraft paper of claim 1, which is bleached.
3. The Kraft paper according to any one of the preceding claims, which comprises inorganic filler, such as clay, in such an amount that the ash content of the Kraft paper is 1-7 %, such as 2-6 %.
4. The Kraft paper according to any one of the preceding claims, wherein the Bendtsen roughness according to ISO 8791-2 of at least one side of the paper is below 250 ml/min, such as below 200 ml/min, such as below 150 ml/min, such as below 100 ml/min, such as below 70 ml/min.
5. The Kraft paper according to any one of the preceding claims, which comprises a hydrophobic size.
6. The Kraft paper according to claim 5, which comprises alum and rosin size.
7. The Kraft paper according to any one of the preceding claims, which comprises starch.
8. A multilayer material comprising:
 - a paper layer having a printing side and a backside, which paper layer is the Kraft paper according to any one of the preceding claims;
 - a first coating layer provided on the printing side; and
 - a second coating layer provided on the backside.
9. The multilayer material according to claim 8, wherein the geometric bending resistance of the multilayer material according to ISO 2493-1 divided by the thickness of the multilayer material according to ISO 534 is at least 1.20 mN/ μ m, preferably at least 1.30 mN/ μ m.
10. The multilayer material according to claim 8 or 9, wherein the first and the second coating layer comprise polyethylene

or polypropylene.

11. The multilayer material according to any one of claims 8-10, wherein the grammage of the multilayer material is 135-175 g/m² according to ISO 536.

12. A pillow pouch composed of the multilayer material according to any one of claims 8-11.

13. A method of producing the Kraft paper according to any one of claims 1-7, comprising:

- a) providing a furnish of softwood Kraft pulp or a mixture of softwood Kraft pulp and hardwood pulp;
- b) diluting the furnish prior to a head box and then forming and dewatering a paper web on a wire section, such as a fourdriner wire section, which may be equipped with a hybrid former for improved dewatering;
- c) wet pressing the paper web from step b) in a press section, which preferably comprises several press nips;
- d) pre-drying the paper web from step c); and
- e) further drying the pre-dried paper web from step d) using a machine glaze (MG) cylinder or a Yankee cylinder (YC).

14. The method according to claim 13, further comprising the step of:

- f) calendering the dried paper from step e) such that a printing side of the resulting paper has a Bendtsen roughness according to ISO 8791-2 below 100 ml/min, such as below 70 ml/min.

15. The method according to any one of claims 13 or 14, wherein the softwood Kraft pulp and the hardwood pulp are bleached.



EUROPEAN SEARCH REPORT

Application Number
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