Title: METHOD OF MANUFACTURING AN OPAQUE PAPER USING GENUS TYPHA L.

Abstract: The present invention relates to a method of manufacturing an opaque paper by using Genus Typha L. The method includes preparing Genus Typha L. bleached pulp from Genus Typha L. and fabricating a paper from the Genus Typha L. bleached pulp. According to the present invention, the method can provide paper with a low basis weight, even if it includes very little or no mineral charging agent but having high opacity, smoothness, and printability. Since it includes very little or no mineral charging agent, it may not have much deteriorated mechanical strength.
[SPECIFICATION]

[Invention Title]
Method of Manufacturing an Opaque Paper using Genus Typha L.

[Technical Field]

The present invention relates to a method of manufacturing an opaque paper by using Genus Typha L. More particularly, the present invention relates to a method of manufacturing a paper with a low basis weight but having excellent mechanical strength as well as high opacity, smoothness, and printability.

[Background Art]

Genus Typha L. is a perennial plant belonging to the Typhaceae family, which includes 9 to 18 species worldwide. In Korea, there are three known species, including Typha Orientalis, Typha Angustata, and Typha Latifolia (Choi, 2000; Chung, 1957; Im, 1998; Kim and Choi, 2001; Lee, 1996; Mori, 1922; Nakai, 1911, 1951). Typha Latifolia and Typha Orientalis have one body of a stamen and a pistil, but are easily distinguished by leaf size. However, Typha Angustata has a stamen and a pistil 4 to 6cm apart from each other, and a small leaf. This Typha Angustata is commonly found all over Korea. In America, they are called broad-leaved cattail (Typha Latifolia L.) or common cattail, and narrow-leaved cattail (Typha Angustatifolia L.). The latter has a stamen and a pistil that are apart from each other as does the Korean Typha Angustata, but is known to have different morphological characteristics.
Genus Typha L. has dried aerial parts above ground but hibernates under the ground in winter, so that it can have a long period of life of more than one year. Its pollen is called Pohwang, and is used as an oriental medicine. Its young buds, stems, roots, and the like may also be used as food. In addition, it has been known to play an important role of purifying impurities in swampy land. Accordingly, research on aquatic plants has been actively performed for purifying water and treating waste water in Korea.

Therefore, Genus Typha L. needs to be cultivated for food or resources as well as for purifying the environment. Since it has well-developed aerial parts and rhizomes, and can thereby produce a lot of biomass, it has been paid attention to as a future bio-energy plant. While rice straw and reeds respectively produces 8.5-1.2 ton/hectare and 6.4-12.5 ton/hectare of dry weight biomass, Genus Typha L. produces 10.6-14.7ton/hectare of biomass. However, it has been reported to produce 14.5-22.7ton/hectare of biomass when a fertilizer is used (Goo, Jahyeung et al., ARPC Report, 2007, p95).

Currently, paper is mainly manufactured by using wood as a raw material. The wood includes cellulose, hemicellulose, and lignin as main components, and is manufactured into pulp through pulping and bleaching processes. In those processes, the lignin is removed from the wood.

Hereinafter, a process of manufacturing bleached pulp from wood is illustrated. First, wood is processed into pulp through cutting, peeling, selecting, and the like. They can be appropriately performed depending on the kinds of wood. Next, fibers are acquired from the material prepared from the above
processes, which is called pulping, which is most important in the pulp manufacturing process.

Illustrated in more detail, fibers are acquired by treating the pulp material with a delignification specimen to dissolve lignin therein. The resulting pulp is called chemical pulp. The chemical pulp is prepared by removing most lignin inside a cell wall as well as in interstitial layers, simultaneously dissolving a lot of hemicellulose, and decomposing some cellulose. It can be manufactured in a sulfurous acid method, a soda method, a sulfate method, a kraft method, and the like. Among these methods, the kraft pulping method is the most common.

Then, the fibers that are pulped from the rough pulp material are refined through washing and selecting to remove residue that is not completely processed into pulp and impurities. The pulp can be additionally bleached if needed. This method of manufacturing pulp from wood requires high temperature and pressure and a lot of chemicals.

In general, a mineral charging agent is included to improve its optical property when wood pulp is manufactured into printing paper. When paper has high opacity in this way, it can be preferred for writing and high-quality printing. Accordingly, paper should be manufactured to appropriately retain a mineral charging agent with fibers during the manufacturing process. Commercially, the charging agent and fibers are cohered by generally including a cationic starch or a similar coherent. However, a mineral charging agent can still be considerably lost in a paper with a low basis weight or an express sheet-forming process in spite of this treatment. When a mineral charging agent remains low,
it may block a felt for paper, contaminate a white water system, and increase raw material cost. The mineral charging agent has included calcium carbonate, titan dioxide, talc, white clay, and other mineral salts. However, when it is overused, the paper may have deteriorated mechanical strength and thereby may not be recycled. In addition, a paper with low a basis weight may not be sufficiently charged with a mineral charging agent.

The mineral charging agent may be most included among the paper materials except for the pulp. In general, it may be included in an amount of 5 to 30 wt%. In the sheet-forming process, a mineral powder such as clay, kaolin, talc, calcium carbonate, and the like is added to a pulp solution in order to make the paper white and opaque and improve its printability, dimensional stability, and writability. However, this mineral charging agent may deteriorate paper strength. Further, when used to manufacture paper with a low basis weight or express paper, it may easily cause contamination due to friction.

Herein, the basis weight denotes mass per unit area. Paper with a low basis weight of less than 100g/m² is usually used in various industries such as newspapers, OA paper, and the like. In general, a paper with a low basis weight needs relatively more mineral charging agent for opacity but inevitably has decreased strength.

Therefore, a method of manufacturing paper with higher opacity without a mineral charging agent is increasingly required.

The above information disclosed in this Background section is only for enhancement of understanding of the background of the invention and therefore
it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

[DETAILED DESCRIPTION]

[Technical Problem]

The present invention has been made in an effort to provide a method of manufacturing paper with excellent opacity, smoothness, and printability by using very little or no mineral charging agent.

[Technical Solution]

An exemplary embodiment of the present invention provides a method of manufacturing paper with a low basis weight but with excellent mechanical strength.

Another embodiment of the present invention provides a method of manufacturing a paper at a low cost but with high quality.

In order to accomplish the aforementioned purposes, an embodiment of the present invention provides a method of manufacturing opaque paper including preparing Genus Typha L. bleached pulp with more than 70% whiteness from Genus Typha L., and then preparing paper from the Genus Typha L. bleached pulp. Another embodiment of the present invention provides paper with a low basis weight but excellent opacity and mechanical strength, even though it includes no inorganic charging agent or includes it in an amount of less than 10 wt%.

According to the embodiment of the present invention, a method of
manufacturing opaque paper with a low basis weight from Genus Typha L. bleached pulp includes little or no mineral charging agent but can provide paper with a low basis weight (mass per unit area) of less than 120g/m². Accordingly, the resulting paper may not have much decreased mechanical strength even though trace amounts of a mineral charging agent are added or there is a lack of a mineral charging agent.

[Advantageous Effects]

Since the Genus Typha L. bleached pulp may have increased mechanical strength and can thereby produce paper with a decreased basis weight, it can contribute to decreasing manufacturing cost.

In addition, it can be manufactured into paper with higher opacity and better smoothness than wood pulp paper including a mineral charging agent. In addition, since it includes less optical material, it may decrease paper cuts.

Furthermore, it can improve paper smoothness and printability. In particular, a paper with a low basis weight retains a mineral charging agent at a very low rate, but Genus Typha L. bleached pulp works as a mineral charging agent and helps a mineral charging agent to be well-retained. Accordingly, it can simplify a retention system and decrease the cost.

[Best Mode]

As the supply of wood has been severely reduced world wide, paper industries are facing the task of simultaneously protecting wood and the environment while producing pulp as a row paper material. In particular,
technologies for producing paper pulp from non-woody fibers have garnered attention.

Non-woody plants for paper pulp include mulberry bast, flax, hemp, cotton plant, rice straw, bagasse, and the like. In general, the non-woody plants include pectin, hemicellulose, and inorganic material in a large amount, but lignin in a small amount. They can be manufactured into pulp in a chemical, semichemical, or mechanochemical method, and can be manufactured into unbleached or bleached pulp under milder conditions than with wood.

The non-woody pulp may have various characteristics depending on the fiber shape, chemical composition, and kinds and amounts of non-fiber cells. Accordingly, when paper is manufactured of non-woody pulp or by appropriately combining the non-woody pulp with wood pulp, it can have easily-adjustable mechanical strength, durability, electrical characteristics, gloss, dimensional stability, and printability, and can thereby be used in various ways.

In the present invention, Genus Typha L. is used as a raw material for fabricating paper. According to one embodiment of the present invention, a method of manufacturing paper includes preparing Genus Typha L. bleached pulp from Genus Typha L., and then fabricating paper from the Genus Typha L. bleached pulp. The paper manufacturing method can provide paper with low basis weight including no conventional mineral charging agent but having much better opacity, mechanical strength, smoothness, and printability than paper including 5 to 30 wt% of a conventional mineral charging agent.

Hereinafter, a paper manufacturing method of the present invention is
illustrated in more detail.

1. Pulping Genus Typha L.

Genus Typha L. is a perennial plant belonging to the Typhaceae family, and includes 9 to 18 species worldwide. In the present invention, it may be at least one selected from the group consisting of Typha Orientalis, Typha Angustata, and Typha Latifolia. However, the present invention is not limited thereto, and may include all kinds of Genus Typha L. that at least include fibers.

In particular, it includes a considerable amount of excellent cellulose fibers that are capable of being made into a special paper, in the leaf and stem. Since it grows faster than wood and can be gathered in most temperate regions, it can sufficiently compete with wood pulp.

When Genus Typha L. is harvested for pollen, its root can be used to manufacture ethanol by using carbohydrates therein, and its leaf and stem are provided as a raw material for manufacturing pulp. When Genus Typha L. is massively cultivated as a pulp material, it can contribute to producing pulp with a low cost but still excellent quality compared with wood. In addition, since it plays an important role of purifying contaminants in swamps, it can additionally bring about water purification effects.

Herein, Genus Typha L. can be produced into pulp through the same process as wood pulp or through a milder process. Before the pulping, the holocellulose of several broaded-leaved chips is mixed with lignin in a dry weight ratio of 62.0 wt% : 24.1 wt%. The holocellulose of the leaf and stem of Genus Typha L. may also be mixed with lignin in a dry weight ratio of 63.2 wt% : 22.3
wt%. Before the pulping, Genus Typha L. includes a higher ash content in a dry weight ratio of 3.8 wt% : 1.72 wt% than that of a broad-leaved tree. However, the ash content of Genus Typha L. decreases to less than 1 wt% based on the dry weight, and thereby presents no problem in use as a fiber.

In general, Genus Typha L. fibers that are used for bleached pulp are very fine. Fine fibers have an increased surface area per unit weight. When they are manufactured into paper, it can have a very smooth surface and can thereby be appropriately used for printing. In addition, since they have a very large surface area, they can be very useful for a filter.

According to the embodiment of the present invention, Genus Typha L. bleached pulp may have ISO whiteness of more than 70%. In another embodiment, it may have ISO whiteness of more than 80%. The Genus Typha L. bleached pulp may have average fiber coarseness ranging from 0.02 to 0.08ug/m. The fiber coarseness denotes completely dry weight of fibers required of 1m in length when the fibers are arranged in a length direction. When fiber coarseness is within the above range, it can be identified to be fine.

The Genus Typha L. bleached pulp may include Klason lignin in an amount of less than 3 wt%. In another embodiment, it may include Klason lignin in an amount of less than 1.5 wt%. In still another embodiment, it may include Klason lignin in an amount ranging from 0.01 to 1.5 wt%. It has some long and wide fibers in a small amount, but they have an average length ranging from 0.4 to 0.9 mm and an average width ranging from 8 to 15 urn. When it has aforementioned whiteness, fiber coarseness, Klason lignin, average fiber length,
and average fiber width, it can be manufactured into paper with excellent smoothness and opacity.

Since both leaf and stem of Genus Typha L. such as Typha Orientalis, Typha Angustata, Typha Latifolia, and the like can be used as a paper material, it can be used as a whole without any separation for convenience. However, Genus Typha L. bleached pulp can have a regulated mechanical strength characteristic and opacity by controlling the amount of leaf and stem in a particular case. When relatively more stem is used than leaf, paper may have high mechanical strength but less opacity and slow dehydration. On the contrary, when relatively more leaf is used, a resulting paper may have high opacity and a fast dehydration characteristic.

When Genus Typha L. is crafted into pulp by using NaOH and Na₂S (activated alkali), the activated alkali (NaOH + Na₂S) may be included in an amount of 5 to 25 parts by weight based on 100 parts by weight of the oven-dried Genus Typha L.. Herein, Na₂S is included in an amount of 5 to 30 wt% (Na₂S/(NaOH+Na₂S)x100%). The pulping of Genus Typha L. with the specimens is effectively performed at a temperature of 140 to 200°C or more at a temperature of 160 to 190°C for 2 to 6 hours. After the pulping, the resulting material is sufficiently washed and then bleached. Herein, the pulping of Genus Typha L. may include all common delignification methods for pulping including a soda process, a sulfate process, a sulfurous acid process, a delignification method by using oxygen, and the like.

The bleaching can be performed by using chlorine, and may include an
ECF (element chlorine free) bleaching process by using ozone, chlorine dioxide, chlorine, hydrogen peroxide, peracetic acid, and the like, or a TCF (total chlorine free) bleaching process by using ozone, hydrogen peroxide, peracetic acid, and the like.

2. Paper Fabrication by using Genus Typha L. bleached pulp

A method of manufacturing paper with the Genus Typha L. bleached pulp is similar to other methods of manufacturing paper, but can provide paper with high opacity, even though it includes sharply less or no mineral charging agent. In general, when a mineral charging agent is included to increase opacity, it may deteriorate mechanical strength of paper. However, since the Genus Typha L. bleached pulp includes a little or no mineral charging agent, it can provide paper with high opacity and high mechanical strength.

According to one embodiment of the present invention, a method of manufacturing paper from Genus Typha L. bleached pulp includes refining Genus Typha L. bleached pulp fibers, sorting and conditioning the refined fibers, and sheet-forming and converting the conditioned paper.

In general, "paper" denotes a sheet fabricated with net-structured cellulose fibers, which can be used for printing, writing, wrapping, and the like. "Papermaking" denotes a process of fabricating paper for each purpose through respective treatments. The papermaking process can vary somewhat depending on purposes of paper, but can be generally illustrated as follows.

1) Refining process

When pulp produced from a pulp factory is fabricated into paper without
any processing, the paper may have very weak strength and extremely high air permeation due to its coarse surface, and therefore may not be used for common purposes. This is because natural fibers are not well-combined with one another since they are strong and have a small surface area.

Accordingly, the fibers should be mechanically treated in water so that they can be appropriately formed to be a sheet. This is a refining process. Since the refining process can make fibers smoother and increase their unity, paper may have a more elaborate structure as the refining degree increases.

2) Sorting and Conditioning Processes

The refined pulp material is treated to remove impurities mixed therewith before the sheet-forming, and to thereby have constant paper properties.

3) Sheet-forming Process

The pulp is mixed with a sizing agent and all kinds of additives. The mixed pulp material is fabricated into paper by forming a paper web on a wire and then pressuring, dehydrating, and drying it. A sizing agent is used to endow the paper with ink or water resistance. The paper web formation on a wire can include fourdrinier, cylinder, and twin wire paper machines.

4) Converting Process

The paper converting process includes coating, laminating, and the like.

The papermaking process provides paper with a low basis weight but high opacity by using very little or no mineral charging agent. When a mineral charging agent is used to increase opacity of paper with a low basis weight of less than 120g/m², it may deteriorate mechanical strength of the paper.
However, since the Genus Typha L. bleached pulp does not include a mineral charging agent, a resulting paper may have a low basis weight but high opacity.

In addition, the method of manufacturing paper from the Genus Typha L. bleached pulp can include a second pulp such as wood pulp or other non-wood pulp other than the Genus Typha L. bleached pulp, depending on the desired paper characteristics. When the Genus Typha L. bleached pulp is included in an amount of 10 to 90 wt%, the second pulp may be included in an amount of 90 to 10 wt%. In another embodiment, if the Genus Typha L. bleached pulp is included in an amount of 50 to 90 wt%, the second pulp may be included in an amount of 10 to 50 wt%. When the Genus Typha L. bleached pulp and the second pulp are mixed within the above range, paper can be fabricated to have desired characteristics in addition to Genus Typha L. bleached pulp characteristics.

The wood pulp may include broad-leaved and needle-leaved pulp in an appropriate ratio. When the mixed wood pulp and Genus Typha L. bleached pulp are used to manufacture paper, the paper can have the same mechanical strength and tensile strength at the same opacity level and relatively better smoothness than paper manufactured by using the mixed wood pulp and a mineral charging agent.

The non-wood pulp can be acquired from mulberry bast, flax, hemp, cotton plant, rice straw, bagasse, red algae, or the like.

In addition, a very small amount of a mineral charge agent may be added in the process of manufacturing paper from the Genus Typha L. bleached pulp.
The mineral charging agent may be selected from the group consisting of clay, kaolin, talc, calcium carbonate, and mixtures thereof. When they are used as a mineral charging agent, they may be included in an amount of less than 10 wt% based on the total weight of the pulp and the mineral charging agent. In another embodiment, they may be included in an amount ranging from 1 to 9 wt%.

Hereinafter, the present invention is illustrated according to exemplary embodiments in more detail. However, the following examples show exemplary embodiments of the present invention but do not limit it.

**Example 1: Preparation of Genus Typha L. bleached pulp**

Genus Typha L. bleached pulp was prepared in a kraft pulping method. Herein, the Genus Typha L. mostly included Typha Angustata. It was used as a whole including leaves, branches, and so on to have average properties of the Genus Typha L. bleached pulp. In addition, a chemical including 12 wt% of activated alkali (NaOH + Na₂S) with 20 wt% of sulfidity was used to prepare a solution based on a dry weight of the Genus Typha L. The solution was mixed with the Genus Typha L. in a weight ratio of 1:4. The mixture was digested for 2 hours, and then was heated up a temperature of 150 °C. The resulting product was sufficiently washed and then bleached with chlorine dioxide at pH 3~4. It was also bleached with hydrogen peroxide at pH 11~13. Accordingly, it could reach ISO whiteness of 84.5%. The following Table 1 shows pulp properties. In addition, it shows measurements of commercially-available
needle-leaved and broad-leaved pulps for comparison with the Genus Typha L. pulp.

A Morfi analyzer (Techpop Co., France) was used to measure average fiber length, average fiber width, fiber roughness, and filler (area %) in Table 1. The ISO whiteness was measured by ISO 2470-1 977. Referring to Table 1, the average fiber length was calculated not as an arithmetic average value but as a length weight value. The filler can be measured as an area % in which less than 0.2mm long fibers were shown.
As shown in Table 1, the Genus Typha L. bleached pulp turned out to have a smaller average fiber length and average fiber width than those of the needle-leaved or broad-leaved pulp. In particular, it had sharply decreased fiber coarseness. In other words, the Genus Typha L. bleached pulp can be used to produce paper with a fine structure.

**Example 2: Paper Fabrication**
As shown in Table 2, a paper basis with a basis weight of 60g/m² was fabricated by refining the Genus Typha L. bleached pulp of Example 1 to have freeness of 450 CSF.

**Example 3: Paper Fabrication**

As shown in Table 2, paper with a basis weight of 60g/m² was fabricated by refining the Genus Typha L. bleached pulp of Example 1 to have freeness of 300 CSF.

**Comparative Example 1: Paper fabrication**

As shown in Table 2, a paper with a basis weight of 60g/m² was fabricated by mixing the commercially-available needle-leaved and broad-leaved bleaching pulps of Example 1 in a weight ratio of 50:50 and refining the pulp mixture to have freeness of 400 CSF.

**Comparative Example 2: Paper Preparation**

As shown in Table 2, a paper with a basis weight of 60g/m² was prepared by mixing the commercially-available needle-leaved and broad-leaved bleaching pulps of Example 1 in a weight ratio of 50:50 to produce a pulp mixture having freeness of 400 CSF, and adding 10wt% of calcium carbonate to the resulting pulp.

**Comparative Example 3: Paper Fabrication**

As shown in Table 2, a paper with a basis weight of 60g/m² was prepared by mixing the commercially-available needle-leaved and broad-leaved bleached pulps of Example 1 in a weight ratio of 50:50, refining the pulp mixture to have freeness of 400 CSF, and adding 20wt% of calcium carbonate to the
resulting pulp.

**Experimental Example**

The papers of Examples 2 and 3 and Comparative Examples 1 to 3 were measured regarding basis weight, density, a breaking length, smoothness, folding endurance, whiteness, opacity, and an ash content. The results are shown in the following Table 2.

The basis weight in Table 2 denotes a paper weight of an area of 1m². The density denotes a paper weight in cm³ and is generally calculated by measuring paper thickness and dividing it by the basis weight. The breaking length denotes tensile strength measured supposing that two different papers having different basis weights have the same basis weight. The Bekk smoothness was measured by using a smoothness measurement device called a Bekk smoothness tester. A higher number denotes more smoothness. The folding endurance denotes frequencies that a paper is torn apart when it is repeatedly folded and unfolded. The ash content denotes a weight of ash left after a paper is burnt at 400 C for more than 1 hour. The whiteness and opacity are respectively measured according to ISO 2470-1977 and ISO 2471-1977.
<table>
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<tr>
<th>Component</th>
<th>Basis Weight (g/m²)</th>
<th>Density (g/cm³)</th>
<th>Breaking Length (km)</th>
<th>Bekk Smoothness</th>
<th>Folding Endurance (times)</th>
<th>Whiteness (ISO) (%)</th>
<th>Opacity (%)</th>
<th>Ash Content (wt%)</th>
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<tr>
<td>Ex. 2 Genus Typha L. bleached pulp, 450 CSF</td>
<td>63.3</td>
<td>0.56</td>
<td>4.66</td>
<td>11.42</td>
<td>4.76</td>
<td>50</td>
<td>83.3</td>
<td>86.2</td>
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<tr>
<td>Ex. 3 Genus Typha L. bleached pulp, 300 CSF</td>
<td>63.1</td>
<td>0.62</td>
<td>6.62</td>
<td>14.76</td>
<td>5.76</td>
<td>393</td>
<td>82.5</td>
<td>85.2</td>
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<tr>
<td>Comp. Ex. 1 Commercially available bleached pulp, 400 CSF</td>
<td>60.5</td>
<td>0.69</td>
<td>6.21</td>
<td>6.00</td>
<td>3.44</td>
<td>566</td>
<td>84.2</td>
<td>73.1</td>
</tr>
<tr>
<td>Comp. Ex. 2 Commercially available bleached pulp, 400 CSF</td>
<td>62.77</td>
<td>0.62</td>
<td>4.16</td>
<td>4.71</td>
<td>2.61</td>
<td>80</td>
<td>84.2</td>
<td>85.5</td>
</tr>
</tbody>
</table>
As shown in Table 2, the papers of Examples 2 and 3 including no mineral charging agent turned out to have higher opacity than that of Comparative Example 1 with the same basis weight of 60g/m².

The paper of Example 3 made of the Genus Typha L. bleached pulp had equivalent opacity to that of Comparative Example 2 fabricated by adding 10 wt% of calcium carbonate to wood pulp. However, the paper of Example 3 had good breaking length of 59%, folding endurance of 300%, and excellent Bekk smoothness. In addition, the paper of Example 2 had the same opacity as that of Comparative Example 3 made of wood pulp. It had good breaking length of 57%, folding endurance of 120%, and excellent smoothness.

The embodiments of the present invention are exemplarily illustrated and
may be modified and altered by those who have common knowledge in this related art within the scope of essential characteristics of the present invention. Accordingly, the present invention is not limited to but is illustrated by the exemplary embodiments. In other words, the present invention should be understood through the following claims. All the technical spirit within the equivalent range to the claims can be understood to be included in the present invention.
[CLAIMS]

[Claim 1]

A method of manufacturing an opaque paper by using Genus Typha L. comprising:

preparing Genus Typha L. bleached pulp with whiteness of more than 70% from Genus Typha L.; and

manufacturing opaque paper from the Genus Typha L. bleached pulp.

[Claim 2]

The method of claim 1, wherein the Genus Typha L. includes a perennial plant selected from the group consisting of Typha Ohentalis, Typha Angustata, Typha Latifolia, and mixtures thereof.

[Claim 3]

The method of claim 1, wherein the Genus Typha L. bleached pulp includes Klason lignin with fiber coarseness ranging from 0.02 to 0.08ug/m and average fiber width ranging from 8 to 15um, at less than 3 wt%.

[Claim 4]

The method of claim 1, which comprises refining Genus Typha L. bleached pulp fiber, sorting and conditioning the refined Genus Typha L. bleached pulp fiber, and sheet-forming and converting the sorted and
conditioned Genus Typha L. bleached pulp fiber.

[Claim 5]
The method of claim 4, wherein the paper fabrication from the Genus Typha L. bleached pulp further comprises wood pulp or non-wood pulp such as mulberry bast, flax, hemp, cotton plant, rice straw, bagasse, or red algae, other than the Genus Typha L. bleached pulp as a second pulp.

[Claim 6]
The method of claim 5, wherein the Genus Typha L. bleached pulp is comprised in an amount of 10 to 90 wt%, and the second pulp is comprised in an amount of 90 to 10 wt%.

[Claim 7]
The method of claim 6, wherein the wood pulp is at least one selected from broad-leaved or needle-leaved pulp.

[Claim 8]
The method of claim 5, wherein the paper formation from the Genus Typha L. bleached pulp further comprises a mineral charging agent in an amount of 1 to 20 wt% based on the total weight of the pulp and the mineral charging agent.
[Claim 9]

A paper with a low basis weight comprising no mineral charging agent or in an amount of less than 10 wt% but having excellent opacity and mechanical strength according to one of the manufacturing methods of claims 1 to 8.
A. CLASSIFICATION OF SUBJECT MATTER

**D21F 11/00(2006.01)i, D21H 11/12(2006.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC D21H

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS/KIPO Internal)

Keywords pulp, Typha, pati, non-wood, no inorganic filler

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
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Date of the actual completion of the international search
30 JANUARY 2009 (30 01 2009)

Date of mailing of the international search report
30 JANUARY 2009 (30.01.2009)

Name and mailing address of the ISA/KR

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Form PCT/ISA/210 (second sheet) (July 2008)
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