

FORM 2

THE PATENTS ACT, 1970

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COMPLETE SPECIFICATION

[See section 10, rule 13]

**TITLE: “A COMPOSITION FOR PLY, PAPER BOARD AND METHODS
THEREOF”**

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The following specification particularly describes the invention and the manner in which it is to be performed.

TECHNICAL FIELD

The present disclosure relates to paper industry. In particular it relates to the production of paperboard using agro waste. The disclosure further relates to a composition for preparing paper board and comprises fiber and agro filler along with retention and drainage aids. The disclosure also provides for methods of obtaining the composition and the paper board using the said agro waste.

BACKGROUND OF THE DISCLOSURE

All paper boards are made with fibers which are mainly cellulose based and such fibers are further classified as recycled and virgin fibers. Most fibers for paper board application are derived from wood whereas most fibers for paper are derived from non wood resource.

As the cost of soft wood increases, the resulting end products cost also increases. To reduce cost of such products, it is generally well known practice to use or add some or substantial amount of recycled and secondary fibers which actually add lot of impurities apart from lowering the strength and also add inconsistency to products as there is no control over type and method of collecting and recovering used fibers.

While most applications can tolerate the impurities and inconsistencies associated with such fibers, there are many critical applications where it is not acceptable.

The increased cost of both used and virgin fibers made it essential to investigate the possible alternatives for such fibers which can be relatively free from impurities, available consistently and also cheap.

It is known that there are number of agricultural products including agricultural wastes which are similar in composition and compatibility to cellulose but do not have the required fiber forming characteristics like cellulose. Examples of such products are coconut shell powder, coconut fiber, coir pith, coco peat, wood and maize cob. The present disclosure aims to use the said agricultural waste effectively for preparation of paper boards.

STATEMENT OF DISCLOSURE

Accordingly, the present disclosure relates to a composition for preparation of paper ply comprising fiber, agro filler, retention and drainage aid (R & D aid), optionally along with binder; a method of obtaining a composition comprising fiber, agro filler, R & D aid, optionally along with binder, said method comprising acts of: a) mixing the fiber with the agro filler to obtain a mix, b) optionally adding the binder to the mix and diluting the mix to obtain a blend, and c) adding the R & D aid to the mix of the step (a) or to the blend of the step (b) to obtain

the composition; a paper board comprising at least one paper ply, wherein the ply is having composition of claim; a method of obtaining paperboard, said method comprising acts of: a) mixing fiber with agro fillers and to obtain a mix, b) optionally adding binder to the mix and diluting the mix to obtain a blend, c) adding R & D aid to the mix of step (a) or to the blend (b) to obtain a composition, d) pouring the composition on paper forming device to obtain paper ply, e) dewatering and drying the paper ply to obtain dried paper ply and f) optionally stacking plurality of the dried paper plies to obtain the paper board; a method of using paper board as mentioned above for electrical insulation, said method comprising act of insulating an electrical conductor with the paper board and a method of using paper board as mentioned above for delivering a substance, said method comprising acts of : a) contacting the paper board with the substance to be delivered and b) vaporizing the substance in contact with the paper board to deliver the substance.

BRIEF DESCRIPTION OF ACCOMPANYING FIGURES

In order that the disclosure may be readily understood and put into practical effect, reference will now be made to exemplary embodiments as illustrated with reference to the accompanying figures. The figure together with a detailed description below, are incorporated in and form part of the specification, and serve to further illustrate the embodiments and explain various principles and advantages, in accordance with the present disclosure where:

Figure 1 shows rate of drying of various paper board compositions as per Examples 1-7.

DETAILED DESCRIPTION

The present disclosure relates to a composition for preparation of paper ply comprising fiber, agro filler, retention and drainage aid (R & D aid), optionally along with binder.

In an embodiment of the present disclosure, the fiber is having a concentration ranging from about 10 % (w/w) to about 99 % (w/w), the agro filler is having a concentration ranging from about 1 % (w/w) to about 80% (w/w), the R & D aid is having a concentration ranging from about 0.001% (w/w) to about 3% (w/w) and optionally the binder is having a concentration ranging from about 0.1 % (w/w) to about 30 % (w/w).

In another embodiment of the present disclosure, the fiber is having a concentration ranging from about 30 % (w/w) to about 70 % (w/w), the agro filler is having a concentration ranging from about 5 % (w/w) to about 60 % (w/w), the R & D aid is having a concentration ranging

from about 0.01 % (w/w) to about 1% (w/w) and optionally the binder is having a concentration ranging from about 1 % (w/w) to about 15 % (w/w).

In yet another embodiment of the present disclosure, the fiber is selected from a group comprising cellulose, used paper and paper board, cotton rag, bleached and unbleached kraft, synthetic fiber, ceramic fiber and glass fiber; and length of fiber ranges from about 0.1mm to about 12mm.

In still another embodiment of the present disclosure, the agro filler is selected from a group comprising coconut shell powder, coconut husk, coir pith, ground nut husk, maize cob, wood, dry leaves and any combination thereof.

In still another embodiment of the present disclosure, size of the agro filler ranges from about 50 mesh to about 500 mesh.

In still another embodiment of the present disclosure, size of the agro filler ranges from about 100 mesh to about 300 mesh.

In still another embodiment of the present disclosure, the binder is selected from a group comprising starch, polymer latex, thermosetting resin and any combination thereof.

In still another embodiment of the present disclosure, the retention and drainage aid is selected from a group comprising aluminum sulfate, cationic acryl amide, cataionic starch, micro particle retention aids and any combination thereof.

The present disclosure also relates to a method of obtaining a composition comprising fiber, agro filler, R & D aid, optionally along with binder, said method comprising acts of:

- a) mixing the fiber with the agro filler to obtain a mix;
- b) optionally adding the binder to the mix and diluting the mix to obtain a blend; and
- c) adding the R & D aid to the mix of the step (a) or to the blend of the step (b) to obtain the composition.

In an embodiment of the present disclosure, the R & D aid is in a solution form with water as a solvent.

The present disclosure also relates to a paper board comprising at least one paper ply, wherein the ply is having composition of claim 1.

In an embodiment of the present disclosure, the paperboard has a density ranging from about 0.2g/cc to about 1.1g/cc.

The present disclosure also relates to a method of obtaining paperboard, said method comprising acts of:

- a) mixing fiber with agro fillers and to obtain a mix;
- b) optionally adding binder to the mix and diluting the mix to obtain a blend;
- c) adding R & D aid to the mix of step (a) or to the blend (b) to obtain a composition;
- d) pouring the composition on paper forming device to obtain paper ply;
- e) dewatering and drying the paper ply to obtain dried paper ply; and
- f) optionally stacking plurality of the dried paper plies to obtain the paper board.

In an embodiment of the present disclosure, the dried paper ply of step (e) or dried paper plies of step (f) are optionally calendared and incorporated with functional aid.

In another embodiment of the present disclosure, the paper forming device is selected from a group comprising cylinder mould, Fourdrinier and inclined Fourdrinier.

In yet another embodiment of the present disclosure, the dewatering and the drying are carried out by a process selected from a group comprising sun drying, air drying, drum drying and restrained drying.

In still another embodiment of the present disclosure, the functional aid is selected from a group comprising colour, insect repellent and perfume and any combination thereof.

The present disclosure also relates to a method of using paper board of claim 12 for electrical insulation, said method comprising act of insulating an electrical conductor with the paper board.

The present disclosure also relates to a method of using paper board of claim 12 for delivering a substance, said method comprising acts of :

- a) contacting the paper board with the substance to be delivered; and
- b) vaporizing the substance in contact with the paper board to deliver the substance.

In an embodiment of the present disclosure, the vaporizing is carried out by a process selected from a group comprising heating and subliming.

In another embodiment of the present disclosure the substance to be delivered is selected from a group comprising insect repellent, perfume and combination thereof.

The present disclosure is drawn, *inter-alia*, to a paper board composition and a paper board made from the composition. More particularly the disclosure relates to a paper board composition which can be used to make paper board which is suitable for number of applications such as electrical insulation material for use in transformer, shoe insole, shank board, gasket, a substance delivery device, a stationery support board, pencil board.

There are various agricultural products which similar in composition and compatibility to cellulose. In an attempt to discover methods of incorporating such abundantly available materials, it is found that there are number of useful characteristics and its associated effects. When such products are incorporated in to the fiber mix in a particular way and in a particular amount; it adds some unexpected results to the end product apart from lowering the cost.

In an embodiment of the present disclosure it is found that when Maize cob powder (MCP), coconut shell powder, coir pith powder are mixed with refined soft wood pulp and retention and drainage aids to facilitate fixing with fibers, they allowed easy dewatering on paper forming device and formed as a pressboard for use in oil filled electrical transformers the cost is drastically reduced with no compromise in electrical insulation characteristics of the press board material. Since these materials are relatively free from impurities and consistent in quality and low in cost unlike secondary fiber materials, this is a very useful feature of the composition.

In another embodiment, the effect of above mix is when the board formed is tried as a combustible paper board strip for delivering substance such as an insect repellent or a perfume, the paper board strip cut from above composition burnt consistently at an appreciably slow pace without the need of an combustion promoter or a retarder. The slow burning characteristics mean lower cost and longer burning duration for a given weight of the strip. The strips of width less than 10mm showed ability to burn at a steady state without tendency of extinguishment, whereas the strips with width above 10mm shows quick extinguishment behavior.

The principal embodiments of the present disclosure provides a composition suitable for paper board for a number of applications described above comprising cellulose fiber, powdery filler

derived from agro materials, processed to a particular range of particle size, optionally mixed with polymer binder or mixture of polymer binders, retention of filler and binder and dewatering on a paper machine to form a paper board using retention and drainage aids, drying of the formed paper board and finishing the paper board with operations such as calendaring, coating of functional aids as such color, substance harmful to insects, perfume or combination of any of these or all of these.

In a further preferred embodiment of the present disclosure the fibers are selected from any known paper making fiber which is having length between 0.1mm to 12mm, more preferably between 1mm to 6mm, even more preferably between 1mm to 3mm.

In one more preferred embodiment of the present disclosure, the types of fibers are preferably selected from cellulose of primary or secondary type.

In one another preferred embodiment of the present disclosure, the type of agro fillers are preferably selected from materials such as coconut shell, coconut husk, coir pith, ground nut husk, maize cob, wood, dry leaves, more preferably maize cob powder, coconut shell powder, coir pith, wood, even preferably coconut shell powder and wood. Further, any combination of the above mentioned agro fillers can also be used for making the composition forming the paper board.

In another preferred embodiment of the present disclosure, the size of agro fillers are preferably in the range of 50 to 500 mesh, more preferably in the range of 100 to 400mesh, even preferably in the range of 150 to 350 mesh.

In one another preferred embodiment of the present disclosure, the amount of agro based fillers are present in the composition preferably in the range of 5% to 70%, more preferably between 10 to 60%, even preferably between 20% to 50%, especially between 30% to 50%

In still another preferred embodiment of the present disclosure, the agro fillers are preferably produced from the process such as pulverizing, hammer milling, by wet or dry grinding, even preferably by pulverizing.

In a one another preferred embodiment of the present disclosure, the amount of optional polymers in the paper board can vary from 0.1% to 30%.

In one another preferred embodiment of the present disclosure, the paperboard is further calendared to attain uniform density and thickness.

In yet another preferred embodiment of the present disclosure, process for producing the board from composition as claimed in claim 1. Comprising steps of:

- a. Mixing refined or unrefined fibers with agro fillers
- b. Optionally adding binders as required
- c. Diluting to required consistency
- d. Dosing or addition of retention and drainage aids
- e. Forming on paper machine wire
- f. Dewatering and drying
- g. Calendaring and finishing and incorporation of functional aids as required.
- h. Further converting the paper board made as above in to required shape and size

In still another preferred embodiment of the present disclosure, the paper board formed is suitable for applications but not limiting to products such as electrical insulation material for oil filled devices such as transformers and capacitors, stationary support, insole material, shank board, gaskets, etc.

In one more preferred embodiment of the present disclosure, the paper board so produced and cut in to strips of width less than 10mm is suitable for applications such as substance delivery device such as an insect repellent and or a perfume but not limiting to these applications.

In one another preferred embodiment of the present disclosure, the substance delivery device made from paperboard composition as disclosed in the present disclosure has plurality of shape, length and size

In an embodiment of the present disclosure, the paper board composition and the process of making the paper board made from the composition are explained using following steps:

1. Firstly, a primary or secondary paper making fiber is pulped and refined.
2. The powder of agro derivative such as coconut shell, coconut husk, coir pith, ground nut husk, is prepared by pulverizing the dried agro derivative in a pulveriser such as the hammer mill so as to get powder of required particle size.

3. The refined or unrefined fiber is mixed with required amount to filler powder pulverized as above in required quantities. Optionally, the filler powder can be mixed in pulper and refined with fiber if required.
4. The fiber filler is optionally added with one or mixture of several binders either at chest or as continuous dosing before or after fan pump.
5. The filler and binder is retained using a retention aid.
6. The mix is formed on a paper machine dewatering arrangement with the aid of a drainage aide. The retention and drainage aid can be either added in chest, preferably dosed before or after the fan pump and amount of drainage aid is adjusted by controlling turbidity of white water.
7. The web formed as above is further dewatered using vacuum press or mechanical press.
8. The dewatered web is later dried as required on either a continuous floatation drier, can drier or a hydraulically operated heat press for complete drying. The web can even be dried under sunlight.

In another embodiment of the present disclosure the choice of drying method is made based on the density and finish of the final product desired. For higher density product such as insulation material for use in electrical devices such as transformer, the restrained hydraulically operated heat press may be chosen. For applications such as stationery board, gasket, insole, substance delivery device, continuous drier type such as flotation drier, can drier may be chosen as these product demand lower density products. Alternatively, a board dried on floatation drier can be further calendared to attain higher density or finish or both.

In another embodiment of the present disclosure, the paper board can also be sun dried which is the lowest cost of drying the board.

In an embodiment, the final dried paper board is optionally coated with functional coatings such as color, a substance harmful to insects, a perfume or combination of any or all of these.

The present disclosure is further elaborated by the following examples and figures. However, these examples should not be construed to limit the scope of the disclosure.

EXAMPLE 1: General preparation of materials and steps involved in their process for use in all examples defined below.

Following method and steps are used for preparing pulp, making or preparing agro powders and mixing all the ingredients and forming sheets (plies) from them:

1. Preparation of unbleached soft wood pulp fiber stock (UBSWP): 347 grams of unbleached soft wood pulp containing 8% moisture is taken and soaked in 20 liters of water for 20 minutes to get 1.6% consistency. It is beaten / refined using a laboratory valley beater to a freeness of 34 ° SR.
2. Preparation of used cellulose fiber stock called as local kraft (LK): 97.5g of used Kraft paper containing 7.7% moisture supplied by used paper suppliers is soaked in 4.402 liters of water for 20 minutes and disintegrated in a laboratory hydropulper till it is properly de-flaked and disintegrated. The freeness of the pulp is measured to be 30 Deg SR.
3. Preparation of agro materials powder: Dried de-corned Maize cob (MCP - maize cob powder) is collected from farmers, coir pith (CPP – coir pith powder)) is collected from coir separating facility near a factory and dried Coconut shell (CSP-coconut shell powder) is collected from local coconut shell suppliers. These materials are passed through a hammer mill pulveriser at least once till acceptable fineness of powder is obtained. The pulverized powder is sieved through a 200 mesh sieve to remove all coarse particles including long fibers. The powders prepared as above had a moisture content in the range of 4% to 8%.
4. Preparation of retention and drainage aid (R&D aid): a solution of 0.1% Nalco 7527 is prepared by mixing 1g in 999g water and stirring using a laboratory stirrer.
5. Method of Preparation of fiber and agro powder furnish: required amount of unbleached soft wood pulp is taken by weight in a bucket and mixed with required amount of agro powder sieved through 200 mesh and mixed using a laboratory stirrer and bucket for five minutes. Consistency is maintained at 2% by adding required amount of water. To this mixture retention and drainage aid is added as 0.1% solution prepared as per step 2.
6. Forming and drying of sheets for preparing paper ply for use as insulation press board by multi layer method and drying under restrained drying method: 10 plies, each of 200gsm by dry weight is formed in paper ply former and kept one above the other and pressed in a hydraulic press heated to 110 Deg C with a stainless steel mesh of size 80 kept on both sides of the sheet to facilitate dewatering during pressing and drying. 4000psi pressure is

maintained during drying and drying is stopped after 27 minutes. The interface temperature is measured by inserting a probe in the centre layer and the temperature vs. time is recorded. The drying rate curve for the experiments carried out for use as insulation pressboard is reported in Figure 1. The moisture of the press board is measured after drying by constant weight method. The finished sheets are expected to have 2.0mm thickness at a density of 1.0g/cc and the results are compared in table 1.

7. Forming and drying of single layer sheets for use as substance delivery device: required amount of local Kraft pulp and agro powder is mixed in a bucket using laboratory stirrer for 10 minutes and consistency of the furnish during mixing is maintained at 2.5%. To this mix, retention and drainage aid is added at 0.3% by weight of furnish (mix of fiber and powder) and 800gsm by dry weight single layer sheets are formed in laboratory paper ply former and the formed sheet is pressed in a cold hydraulic press to get a moisture of 65% and then dried in a hot air oven at 150 Deg C for 30 minutes. The results of various experiments for use as substance delivery device is reported in table no 2.
8. Preparation of latex: a solution of 5.0% Pidicryl 3540 S which is an acrylic emulsion polymer manufactured by Pidilite Industries Limited, India is prepared by mixing 40g Pidicryl 3540 S in 360g water and stirring using a laboratory stirrer for five minutes. Viscosity of the latex measured to be 12 seconds by B4 cup and had a pH of 6.2.

EXAMPLE 2: Preparation of paper plies (sheets) useful for application such as electrical insulation press board (a)

This example describes steps involved for preparing an electrical insulation press board by method known in prior art where only 100% unbleached soft wood pulp (UBSWP) is used. It is aimed to make 2.0mm thick final sheet with a density of 1.0g/cc using 10 plies of 200gsm each by dry weight.

250ml of furnish prepared as per step 1 is taken in a beaker and poured in to sheet former, added with water to the upper mark on sheet former and formed in to a sheet. The consistency in the sheet former is measured to be 0.05%. Ten such sheets are formed and kept one above the other and dewatered and dried directly on heated press as described in step 6.

The characteristics of the board prepared is compared in table 1

EXAMPLE 3: Preparation of paper plies useful for application such as electrical insulation press board (b)

This example shows effect of adding 30% coconut shell powder with 70% unbleached soft wood pulp.

4375ml of UBSWP prepared as in step 1 is mixed with 30g of coconut shell powder prepared as per step 3 and mixed with 100ml of retention and drainage aid prepared as per step 4 and mixed as per procedure explained in step 5. 200ml of this furnish is taken and formed in the sheet former by diluting to consistency 0.05%. Ten such plies are formed and insulation press board is formed as per step no. 6 of Example 1.

The properties of the Paper ply are compared in table 1.

EXAMPLE 4: Preparation of paper plies useful for application such as electrical insulation press board (c)

This example shows effect of adding 10% coconut shell powder with 90% unbleached soft wood pulp.

5625ml of UBSWP prepared as in step 1 is mixed with 10g of coconut shell powder prepared as per step 3 and mixed with 100ml of retention and drainage aid prepared as per step 4 and mixed as per procedure explained in step 5. 230ml of this furnish is taken and formed in the sheet former by diluting to consistency 0.05%. Ten such plies are formed and insulation press board is formed as per step no. 6 Example 1.

The properties of the Paper ply are compared in table 1

EXAMPLE 5: Preparation of paper plies useful for application such as electrical insulation press board (d)

This example shows effect of adding 30% coir pith powder with 70% unbleached soft wood pulp.

4375ml of UBSWP prepared as in step 1 is mixed with 30g of coir pith powder prepared as per step 3 and mixed with 100ml of retention and drainage aid prepared as per step 4 and mixed as per procedure explained in step 5. 200ml of this furnish is taken and formed in the sheet former by diluting to consistency 0.05%. Ten such plies are formed and insulation press board is formed as per step no. 6.

The properties of the Paper ply are compared in table 1

EXAMPLE 6: Preparation of paper plies useful for application such as electrical insulation press board (e)

This example shows effect of adding 10% coir pith powder with 90% unbleached soft wood pulp.

5625ml of UBSWP prepared as in step 1 is mixed with 10g of coir pith powder prepared as per step 3 and mixed with 100ml of retention and drainage aid prepared as per step 4 and mixed as per procedure explained in step 5. 230l of this furnish is taken and formed in the sheet former by diluting to consistency 0.05%. Ten such plies are formed and insulation press board is formed as per step no. 6.

EXAMPLE 7: Preparation of paper plies useful for application such as electrical insulation press board (e)

This example shows effect of adding 30% maize cob powder with 70% unbleached soft wood pulp.

4375ml of UBSWP prepared as in step 1 is mixed with 30g of maize cob powder prepared as per step 3 and mixed with 100ml of retention and drainage aid prepared as per step 4 and mixed as per procedure explained in step 5 but sieved to 100 mesh instead of 200 mesh. 200ml of this furnish is taken and formed in the sheet former by diluting to consistency 0.05%. Ten such plies are formed and insulation press board is formed as per step no. 6.

The properties of the Paper ply are compared in table 1

EXAMPLE 8: Preparation of paper plies useful for application such as electrical insulation press board (f)

This example shows effect of adding 10% maize cob powder with 90% unbleached soft wood pulp.

5625ml of UBSWP prepared as in step 1 is mixed with 10g of maize cob powder prepared as per step 3 but sieved to 100 mesh instead of 200 mesh and mixed with 100ml of retention and drainage aid prepared as per step 4 and mixed as per procedure explained in step 5. 230ml of this furnish is taken and formed in the sheet former by diluting to consistency 0.05%. Ten such plies are formed and insulation press board is formed as per step no. 6.

Table 1: Composition and properties of sheets (plies) made as described in examples:

Example		2 (control)	3	4	5	6	7	8
Composition	Units	UBSW BL 100%	CSP- 30%	CSP- 10%	CPP- 30%	CPP- 10%	MCP- 30%	MCP- 10%
Final oSR	osr	37.5	39	34.5	43	34	34	45
GSM	GSM	1949	1782	2043	1871	2057	1812	2059
Thickness	mm	1.88	1.81	2.02	1.75	1.94	1.74	1.92
Density	g/cc	1.036	0.984	1.02	1.069	1.05	1.041	1.07
Drainage time in sheet former for 200gsm sheet	seconds	62	54	54	61	57	45	45
Web moisture	%	91	90	90.48	90.77	91.55	91	92.19
Time to reach 130 deg temperature	minutes	21	15	20	18.5	20	16	19
Final board moisture	%	1.76	1.4	2.87	1.66	2.99	1.27	2.34
Tensile strength	Kg/cm ²	892	702	843	759	883	842	893
Elongation	mm	3.12	3	3.55	3.43	3.47	3.52	3.37
Z-Tensile strength	Kg	70	70	88	81	106	79	76
Dielectric strength- Break down voltage in air (BDV-air)	KV/mm	10.59	7.55	8.82	10.04	9.75	9.89	10.63

The process and the product data from the table 1 show the following:

1. Effect of maize cob powder: has improved Z directional tensile strength with no drop in any properties up to 30% addition compared to control. Maize cob examples are also the fastest to dry. The drying time found to be lesser by up to 20%. This means lower drying cost of paper board (fig 1).
2. Marginal drop in tensile strength observed in examples with coir pith powder and coconut shell powder with a marginal drop in dielectric strength values.

3. Drying time also found low in examples with coir pith powder and coconut shell powder up to 28% which means they can be produced at a higher output at a lower energy cost. This is better evident from in fig 1.
4. Noticeable drop in drainage time in all the examples comprising agro powders means faster dewatering on paper machine forming, reduction in load on vacuum.
5. Since there is no refining required for the powders added, it will help to reduce the energy cost of the press board made with these composition.

In summary the paper board composition of the present disclosure results in a lower cost insulation material which can also be produced at a lower energy cost with little or no compromise in board properties with improved Z directional tensile properties.

Further, the examples below describe preparing paper board suitable for substance delivery device application such as an insect repellent and or a perfume. The steps involved in preparation of materials and process are same as defined earlier. The densities of the boards are maintained low to facilitate easy combustion as low density boards provide more oxygen diffusion

EXAMPLE 9: Paper board composition and paper board for use as substance delivery device (a)

This example describes using 100% used cellulose fiber for preparing paper board using fiber prepared as per step 2. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

880ml of furnish prepared as per step 2 is taken in a beaker and poured in to sheet former, added with water to the upper mark on sheet former and formed in to a sheet. The consistency in the sheet former measured to be 0.2%. The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 ° C for 30 minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (8-10%) by keeping it in open ambient for 24 hours.

5mm wide and 90mm long strips are cut from these sheets and the strips are lighted and allowed to burn. The rate of burning is measured by minutes per gram weight of strip as well as minutes per centimeter length of the strip.

The results are compared in table 2.

EXAMPLE 10: Paper board composition and paper board for use as substance delivery device (b)

This example describes using 70% used cellulose fiber for preparing paper board using fiber prepared as per step 2 and 30% coconut shell powder prepared as per step 3 along with retention and drainage aid prepared as per step 4. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

3500ml of furnish prepared as per step 2 is taken in a bucket with stirrer along with 30g of coconut shell powder (CSP) and mixed for 10 minutes. 300ml of retention and drainage aid is added to this mix. 571ml of this mix is poured into a paper ply former and further diluted to a consistency of 0.2% and formed in to a sheet. The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 °C for 30 minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (8-10%) by keeping it in open ambient for 24 hours.

5mm wide and 90mm long strips are cut from these sheets and the strips are lighted and allowed to burn. The rate of burning is measured by minutes per gram weight of strip as well as minutes per centimeter length of the strip.

The results are compared in table 2.

EXAMPLE 11: Paper board composition and paper board for use as substance delivery device (c)

This example describes using 90% used cellulose fiber for preparing paper board using fiber prepared as per step 2 and 10% coconut shell powder prepared as per step 3 along with retention and drainage aid prepared as per step 4. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

4500ml of furnish prepared as per step 2 is taken in a bucket with stirrer along with 10g of coconut shell powder (CSP) and mixed for 10 minutes. 200ml of retention and drainage aid is added to this mix. 761ml of this mix is poured in to a paper ply former and further diluted to a consistency of 0.2% and formed in to a sheet. The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 °C for 30

minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (8-10%) by keeping it in open ambient for 24 hours.

5mm wide and 90mm long strips are cut from these sheets and the strips are lighted and allowed to burn. The rate of burning is measured by minutes per gram weight of strip as well as minutes per centimeter length of the strip.

The results are compared in table 2.

EXAMPLE 12: Paper board composition and paper board for use as substance delivery device (d)

This example describes using 70% used cellulose fiber for preparing paper board using fiber prepared as per step 2 and 30% coir pith powder (CPP) prepared as per step 3 along with retention and drainage aid prepared as per step 4. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

3500ml of furnish prepared as per step 2 is taken in a bucket with stirrer along with 30g of coir pith powder (CPP) and mixed for 10 minutes. 300ml of retention and drainage aid is added to this mix. 571ml of this mix is poured in to a paper ply former and further diluted to a consistency of 0.2% and formed into a sheet. The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 ° C for 30 minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (8-10%) by keeping it in open ambient for 24 hours.

5mm wide and 90mm long strips are cut from these sheets and the strips are lighted and allowed to burn. The rate of burning is measured by minutes per gram weight of strip as well as minutes per centimeter length of the strip.

The results are compared in table 2.

EXAMPLE 13: Paper board composition and paper board for use as substance delivery device (e)

This example describes using 90% used cellulose fiber for preparing paper board using fiber prepared as per step 2 and 10% coir pith powder (CPP) prepared as per step 3 along with retention and drainage aid prepared as per step 4. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

4500ml of furnish prepared as per step 2 is taken in a bucket with stirrer along with 10g of coir pith powder (CPP) and mixed for 10 minutes. 200ml of retention and drainage aid is added to this mix. 761ml of this mix is poured into a paper ply former and further diluted to a consistency of 0.2% and formed into a sheet. The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 °C for 30 minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (8-10%) by keeping it in open ambient for 24 hours.

5mm wide and 90mm long strips are cut from these sheets and the strips are lighted and allowed to burn. The rate of burning is measured by minutes per gram weight of strip as well as minutes per centimeter length of the strip.

The results are compared in table 2.

EXAMPLE 14: Paper board composition and paper board for use as substance delivery device (f)

This example describes using 70% used cellulose fiber for preparing paper board using fiber prepared as per step 2 and 30% maize cob powder (MCP) prepared as per step 3 along with retention and drainage aid prepared as per step 4. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

3500ml of furnish prepared as per step 2 is taken in a bucket with stirrer along with 30g of maize cob powder (MCP) and mixed for 10 minutes. 300ml of retention and drainage aid is added to this mix. 571ml of this mix is poured into a paper ply former and further diluted to a consistency of 0.2% and formed into a sheet. The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 Deg C for 30 minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (8-10%) by keeping it in open ambient for 24 hours.

5mm wide and 90mm long strips are cut from these sheets and the strips are lighted and allowed to burn. The rate of burning is measured by minutes per gram weight of strip as well as minutes per centimeter length of the strip.

The results are compared in table 2.

EXAMPLE 15: Paper board composition and paper board for use as substance delivery device (g)

This example describes using 90% used cellulose fiber for preparing paper board using fiber prepared as per step 2 and 10% maize cob powder (MCP) prepared as per step 3 along with retention and drainage aid prepared as per step 4. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

4500ml of furnish prepared as per step 2 is taken in a bucket with stirrer along with 10g of maize cob powder (MCP) and mixed for 10 minutes. 200ml of retention and drainage aid is added to this mix. 761ml of this mix is poured in to a paper ply former and further diluted to a consistency of 0.2% and formed into a sheet. The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 ° C for 30 minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (8-10%) by keeping it in open ambient for 24 hours.

5mm wide and 90mm long strips are cut from these sheets and the strips are lighted and allowed to burn. The rate of burning is measured by minutes per gram weight of strip as well as minutes per centimeter length of the strip.

The results are compared in table 2.

Table 2: paper board composition for substance delivery device application and its performance comparison for examples 8 to 14.

Example no		Conventional mosquito coil	Conventional mosquito coil	9	10	11	12	13	14	15
Formulation	Units	Mortein brand power booster coil	Good Knight brand maha Jumbo coil	Local Kraft-100%	CSP-30%	CSP-10%	CPP-30%	CPP-10%	MCP-30%	MCP-10%
Batch no		-	-	7	1	4	2	5	3	6
Gsm of paper board	g/m ²	Coil wt-19.3	Coil wt-18.4	798	806	781	801	790	851	803

Thickness	mm	-	-	1.5	1.51	1.4	1.68	1.43	1.6 3	1.43
Density	g/cc	-	-	0.53	0.53	0.56	0.48	0.55	0.5 2	0.56
Gsm	g/m ²	-	-	863	877	857	875	864	932	879
Wet Web moisture	%	-	-	64	65	66	66	65	63	66
Burning time of strip in Minutes/g weight of strip	Min/gm	28.08	30.11	EX	64	82	54	79	69	EX
Strip burning time in Minutes/CM length of strip	Min/cm	5.44	5.55	EX	2.33	3.16	2.25	3.15	3.0	EX
Continuous Burning		OK	OK	EX	OK	EX	OK	EX	OK	EX

EX: means the burning strip extinguished with no sustainable burning characteristics.

OK: means strip burnt completely.

The Good night and Mortien brand coils are purchased from local retail stores.

The results from the above table shows 100% local Kraft made strips do not burn at all, whereas addition of 10% agro powders shows improved burning ability but some strips shows tendency to extinguish. When amount of agro powder increased to 30%, all strips started burning at rate which is substantially higher compared to available technology substance delivery devices. Composition with maize cob shows highest burning time in minutes per gram weight of strip compared to other agro powders. The compositions of the present disclosure show that for same burning time, the weight of the substance delivery device for use in applications such as insect repellent or perfume, will be significantly lower along with additional benefits such as ability to produce in many colors, unbreakability, no dependency on forest and woody resources thereby saving cost, ecology and reducing environmental footprint.

EXAMPLE16: Paper board composition and paper board for application such as shoe insole wherein the composition comprises cellulose fiber, agro powder and a polymer binder

This example describes paper board comprising composition made using 70% used cellulose fiber for preparing paper board using fiber prepared as per step 2, 30% coconut shell powder prepared as per step 3 and Latex solution is added prepared as per step 8 along with retention and drainage aid prepared as per step 4. The paper board is formed in a sheet former as a single layer sheet and dried in a hot air oven.

3500ml of furnish prepared as per step 2 is taken in a bucket with stirrer along with 30g of coconut shell powder (CSP) and mixed for 10 minutes. 400ml of latex (Pidicryl 3540 S) prepared as per step 8 and for 5 minutes. 1250ml of retention and drainage aid is added to this mix. 910ml of this mix is poured into a paper ply former and further diluted to a consistency of 0.26% and formed in to a sheet (ply). The formed sheet is dewatered in a laboratory cold hydraulic press at a pressure of 2000psi along with two layers of blotting sheet and one sheet of felt on both sides. The pressure is adjusted to get sheet moisture of 65%. The dewatered sheet is then dried in an electric hot air oven at a temperature of 150 °C for 30 minutes which attains complete drying by this time. The dried sheet is allowed to reach equilibrium moisture (6-8%) by keeping it in open ambient for 24 hours.

Table 3: Properties of sheets made as described in example 16:

Properties	Units	Example16
GSM	Grams/sq	1058
Thickness	mm	1.65
Density of the paper board	g/cc	0.64
Drainage time of the sheet on sheet former	Sec	240
Freene's of the furnish in °SR	Degrees	42
Web moisture	%	63
Dry tensile	Kg/cm ²	106
Z tensile	kgs	79
Board moisture after drying for 30 minutes at 150 Deg C	%	7
Water absorption	%	95

The paper board made with composition as described in example 16 is suitable for use as shoe insole which require good flexibility, low water absorption and higher Z directional tensile strength. This composition is also suitable for use as shoe stiffener material.

Advantages:

The present disclosure provides a paper board composition and a process of preparing the paperboard from the said composition which uses fillers from agro derivatives which are of renewable resources with no environmental footprint.

The paper board composition uses materials which are light in weight and available abundantly at low cost, many times which are waste end products such as wood dust there by reducing the cost of the board.

The paperboard made from the disclosure of the paper board composition is having unique characteristics such as low density which results in lower cost of the product.

The paperboard made from the disclosure of the paper board composition particularly when made with coconut shell powder is having unique characteristics such as very good compatibility for use as insulation material for use in oil filled electrical devices such as transformer and capacitors due to their very good dielectric properties.

The paperboard made from the disclosure of the paper board composition is having further unique characteristics such as sustained and controlled burning which is useful for substance delivery which are harmful to insects and or a perfume with strips of less than 10mm wide in size.

The paperboard having one more unique characteristic such as it can reduce the tendency of the paper board to delaminate.

Yet another advantage of the paper board made from the disclosure of the paper board composition is when added with a binder, it is suitable to be used in number of other applications but not limiting products such as shoe insole, shank board, stationary board and gasket.

Further the present disclosure provides a composition which enhances the drying rate of paper board thereby reducing cost of drying of the paper board.

One another advantage of the composition of the paper board is it can be produced in any shape and size on most conventional paper board making machines.

We claim:

1. A composition for preparation of paper ply comprising fiber, agro filler, retention and drainage aid (R & D aid), optionally along with binder.
2. The composition as claimed in claim 1, wherein the fiber is having a concentration ranging from about 10 % (w/w) to about 99 % (w/w), the agro filler is having a concentration ranging from about 1 % (w/w) to about 80% (w/w), the R & D aid is having a concentration ranging from about 0.001% (w/w) to about 3% (w/w) and optionally the binder is having a concentration ranging from about 0.1 % (w/w) to about 30 % (w/w)
3. The composition as claimed in claim 2, wherein the fiber is having a concentration ranging from about 30 % (w/w) to about 70 % (w/w), the agro filler is having a concentration ranging from about 5 % (w/w) to about 60 % (w/w), the R & D aid is having a concentration ranging from about 0.01 % (w/w) to about 1% (w/w) and optionally the binder is having a concentration ranging from about 1 % (w/w) to about 15 % (w/w).
4. The composition as claimed in claim 1, wherein the fiber is selected from a group comprising cellulose, used paper and paper board, cotton rag, bleached and unbleached kraft, synthetic fiber, ceramic fiber and glass fiber; and length of fiber ranges from about 0.1mm to about 12mm.
5. The composition as claimed in claim 1, wherein the agro filler is selected from a group comprising coconut shell powder, coconut husk, coir pith, ground nut husk, maize cob, wood, dry leaves and any combination thereof.
6. The composition as claimed in claim 1, wherein size of the agro filler ranges from about 50 mesh to about 500 mesh.
7. The composition as claimed in claim 1, wherein size of the agro filler ranges from about 100 mesh to about 300 mesh.
8. The composition as claimed in claim 1, wherein the binder is selected from a group comprising starch, polymer latex, thermosetting resin and any combination thereof.
9. The composition as claimed in claim 1, wherein the retention and drainage aid is selected from a group comprising aluminum sulfate, cationic acryl amide, cataionic starch, micro particle retention aids and any combination thereof.
10. A method of obtaining a composition comprising fiber, agro filler, R & D aid, optionally along with binder, said method comprising acts of:
 - a) mixing the fiber with the agro filler to obtain a mix;
 - b) optionally adding the binder to the mix and diluting the mix to obtain a blend; and

- c) adding the R & D aid to the mix of the step (a) or to the blend of the step (b) to obtain the composition.
- 11. The method as claimed in claim 10, wherein the R & D aid is in a solution form with water as a solvent.
- 12. A paper board comprising at least one paper ply, wherein the ply is having composition of claim 1.
- 13. The paper board as claimed in claim 12, wherein the paperboard has a density ranging from about 0.2g/cc to about 1.1g/cc.
- 14. A method of obtaining paperboard, said method comprising acts of:
 - a) mixing fiber with agro fillers and to obtain a mix;
 - b) optionally adding binder to the mix and diluting the mix to obtain a blend;
 - c) adding R & D aid to the mix of step (a) or to the blend (b) to obtain a composition;
 - d) pouring the composition on paper forming device to obtain paper ply;
 - e) dewatering and drying the paper ply to obtain dried paper ply; and
 - f) optionally stacking plurality of the dried paper plies to obtain the paper board.
- 15. The method as claimed in claim 14, wherein the dried paper ply of step (e) or dried paper plies of step (f) are optionally calendared and incorporated with functional aid.
- 16. The method as claimed in claim 14, wherein the paper forming device is selected from a group comprising cylinder mould, Fourdrinier and inclined Fourdrinier.
- 17. The method as claimed in claim 14, wherein the dewatering and the drying are carried out by a process selected from a group comprising sun drying, air drying, drum drying, and restrained drying.
- 18. The method as claimed in claim 14, wherein the functional aid is selected from a group comprising colour, insect repellent and perfume and any combination thereof.
- 19. A method of using paper board of claim 12 for electrical insulation, said method comprising act of insulating an electrical conductor with the paper board.
- 20. A method of using paper board of claim 12 for delivering a substance, said method comprising acts of :
 - (a) contacting the paper board with the substance to be delivered; and
 - (b) vaporizing the substance in contact with the paper board to deliver the substance.

21. The method as claimed in claim 20, wherein the vaporizing is carried out by a process selected from a group comprising heating and subliming.
22. The method as claimed in claim 20, wherein the substance to be delivered is selected from a group comprising insect repellent, perfume and combination thereof.

Dated this 15th day of March, 2011

Signature:

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To:
The Controller of Patents,
The Patent Office, at Chennai

ABSTRACT

A COMPOSITION FOR PLY, PAPER BOARD AND METHODS THEREOF

The present disclosure provides composition and a paper board made from the said composition involving the process of mixing cellulose fiber with powders of known size and type derived from agro materials and optionally mixing with binders with the said fiber - filler mix, retention and dewatering of fiber mix followed by drying of the paper board. The paper board so formed is optionally calendared and coated with functional aids. The resulting board is useful for number of applications such as a low cost replacement for products such as electrical insulation material, stationery support, substance delivery device, gasket, insole, shank board, etc. The said paper board composition can be produced on any conventional paper making techniques in any size and shape.