



# Fiber Blending Techniques for Ipomoea Flower and Bamboo Fiber in the Paper Industry

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## Abstract:

Almost every paper industry uses the technique of fiber blends. The paper industry primarily employs three techniques in the fiber blend process. This research deals with the study of all three types of fiber blending methodologies and it also makes observations about the paper properties concerning the mode of blending fiber. This research gives information regarding the fiber blend analysis and how the modes of fiber blend affect paper properties. This research focuses fully on the strength properties of the paper for the modes of all three fiber blends. The strength properties of paper, like bursting index, tearing index, and tensile index, were observed as the types of fiber blending. Pulp or fiber blending can be done in three distinct ways, i.e. chip blending, pulp blending before beating, and pulp blending after beating. Both brightness and porosity are essential qualities for a paper. Brightness provides good visual appeal to a paper. On the other hand, porosity produces perfect air permeability to a paper and this helps to create the ability to package. The only ipomoea fibers have good physical strength but less porosity. Also, bamboo fibers have less physical strength but high porosity. To achieve the perfect solution to this problem, the fiber blending technique provides the best solution. The blended fiber of bamboo and ipomoea gives both of these characteristics. This research deals with the study of bamboo and ipomoea flower fiber, their blends, characteristics and different properties.

**Keywords:** Fiber Blending, Ipomoea Flower, Bamboo Fiber, Brightness, Porosity

## Introduction

The printing and packaging industries completely depend on the paper industry. The paperboards are classified into mainly two types: virgin and recycled boards. The virgin paper boards are made from virgin fiber material. It means virgin fiber board requires virgin fiber material like forest wooden fiber. Forest harvesting affects climate change day by day. Climate change is a big issue for the modern world. The demand of the paper industry requires the best solution for virgin fiber. The agro-based fiber material is a small solution to this problem. Ipomoea and bamboo fiber are both agro-based fibers. The bamboo and ipomoea fibers provide the best solution to the paper industry. Bamboo fiber has various special characteristics, but ipomoea fiber also has its own

properties. For a perfect solution of bamboo and ipomoea fiber, experts blend both of the fibers in various percentages. Because the ipomoea flowers have less porosity but provide perfect physical strength, On the other hand, bamboo fiber produces less physical strength but good porosity.

**Ipomoea:** Ipomoea is a special kind of fiber. It consists of the cellulose substitute that is important for paper manufacturing. It is the largest genus in the flowering plant family Convolvulaceae, with over 600 species, approximately. Ipomoea is a large and diverse group, with common names including morning glory, water convolvulus or kangkung, sweet potato, bindweed, moonflower, etc. Ipomoea use is the fastest growing fiber in the paper industry.

**Bamboo:** The cultivation of bamboo is very common in India. This is also the core of the natural fiber. This fiber is widely used in the paper manufacturing industry.

**Bursting index:** The bursting index of the paper is a property of strength. The bursting index is the strength or capacity of the material to maintain continuity when subjected to pressure per unit area. Or it is defined by the ratio of bursting strength to basic weight.

Burst index (kPa. m<sup>2</sup>/g) = Burst Strength/Basis Weight.

**Tearing index:** The tearing index of the paper is a strength property. Tearing strength is defined as the force required to start or to continue to tear a fabric in either the weft or warp direction, under specified conditions. A tear in a fabric or garment generally occurs progressively along a line and can be initiated by a moving fabric being caught on a sharp object.

The tensile index is defined by the tensile strength per unit gram. The tensile index of the paper is a strength property.

Tensile Index = Tensile strength per grammage, quoted in Nm/g.

## Mode of fiber blending

In the pulp and paper industries, the cellulose fiber blending can be done in three different ways, i.e., chip blending, the pulp blending after beating, and the pulp blending before beating. Pulp blending consists of three main types, which includes:

- i. **The chips blend:** In this process, the chips of the bamboo and Ipomoea are blended with each other directly. The chips of fibers may or may not be from forest trees. In this terminology, paper industries are blending chips in different proportions, followed by pulping. The chip blending of the fiber produces an increment in the physical and strength properties.
- ii. **Before beating, the pulp is blended:** In this process, the pulps of the bamboo and Ipomoea are blended with each other before the beating process. The pulps of fibers may or may not be from forest trees. In this terminology, the paper industries are blending the unbeaten pulps in different proportions before beating. The pulp blending of the fiber produces an increment in the physical and strength properties better than chip blending.
- iii. **After beating, the pulp blends:** In this process, the pulps of the bamboo and Ipomoea are blended with each other after the beating process. The pulps of fibers may or may not be from forest trees. In this terminology, paper industries blend beaten pulp into different proportions before sheet formation. The pulp blending of the fiber produces an increment in the physical and strength properties better than the pulp blending of before beating and chip blending.

**Brightness:** The brightness is really very common property of the paper. Brightness property gives information about the visual appeal of a paper. Brightness can measure by the amount of reflectance of a specific wavelength

of blue light. The paper industries have scale to measure brightness which have numbers from 0 to 100, if the higher the number in scale, the paper is more the brighter. In other words, if the brightness scale number is 98 the paper reflects more light and brighter than if the brightness scale number is 88 the paper reflects less light and less bright.

### ***Brightness Testing Instruments***

Now-a-days so many different kinds of the reflectance devices which shows digital reflection numbers. But according to ISO standards brightness measures in an environment with cool-white fluorescent light and some unfiltered daylight and the light will hit from all different angles to sheets.

Brightness and whiteness both are the two different characteristics of the paper. The whiteness of the paper informs that how much a paper is white on the other hand brightness means how much a paper is bright. Thus, it is normally justified that both are the two different characteristics of the paper.

### **Porosity:**

Air permeance or porosity is the property of paper that means how much air is passed through the paper in unit cross section area in unit time and pressure, under specified conditions. Its derived unit is  $1\mu\text{m}/\text{Pa}\cdot\text{s}$ . Porosity is providing knowledge about the moisture protection ability of paper when it uses in packaging industry.

### ***Porosity Testing Devices:***

- i. Pira printing smoothness tester
- ii. Bekk air leak tester
- iii. Bendtsen roughness tester
- iv. Parker print surface air leak tester.

### **Research Objective:**

The main objectives of research are:

- i. To study on the burst index, tear index, and tensile index of paper with respect to the mode of fiber blending, different types of fiber blending and their techniques.
- ii. Study of bamboo fiber, ipomoea flower fiber, blend analysis (bamboo and ipomoea fiber) and physical characteristics of their paper.

### **Research Methodology**

The predicated research work was carried out in the paper industry of the Uttarakhand region. The research work was based on the study of fibrous blending techniques. All three types of blends were undertaken in order to analyze the physical and strength properties. First and foremost, the selection of appropriate instruments and equipment was made as per the requirement for data measurement. Before using any instrument or equipment, it was calibrated.

### **Data Collection**

The data was collected in three different segments, and all these segments are listed below:

- i. The Blending before the beating,
- ii. Chips blend in and
- iii. After beating, the blending

The physical and strength properties of all three aforesaid types of blending were measured one by one. In the fibrous blending, partially 10% bamboo was inserted in ipomoea with each section. Strength properties such as bursting, tearing, and tensile index were measured and data were collected in relation to fibrous blending and their technique as tabulated in Table 1.

Table 1: Ipomoea and bamboo blending % with respect to mode of blending

Bamboo (%)	Ipomoea (%)	<i>Blending before beating</i>			<i>Blending after beating</i>			<i>Chips blending</i>		
		<b>Burst index</b>	<b>Tear index</b>	<b>Tensile index</b>	<b>Burst index</b>	<b>Tear index</b>	<b>Tensile index</b>	<b>Burst index</b>	<b>Tear index</b>	<b>Tensile index</b>
00	100	3.76	3.96	70.37	3.87	3.66	70.37	3.77	3.67	70.37
10	90	3.87	4.39	69.96	3.79	3.76	69.36	3.69	3.7	68.39
20	80	4.27	4.76	69.93	3.56	4.02	68.56	3.67	3.84	65.74
30	70	4.28	4.83	69.46	3.89	4.16	67.2	3.89	3.87	65.29
40	60	4.32	4.84	69.44	4.06	4.26	65.86	3.97	4.05	65.9
50	50	4.56	4.86	69.27	4.16	4.66	65.66	4.06	4.27	64.61
60	40	4.71	4.96	68.73	4.19	4.98	65.6	4.1	4.78	63.67
70	30	4.79	4.96	68.42	4.26	5.04	64.6	4.12	5.16	63.17
80	20	4.81	5.11	68.36	4.76	5.25	64.27	4.16	5.17	64.26
90	10	5.26	5.37	67.87	5.16	5.4	64.06	4.22	5.33	63.86
100	00	5.29	5.44	62.45	5.31	5.57	64.04	4.29	5.37	63.37

**In the context of chip blending:** The strength properties of ipomoea were measured after 10% bamboo was inserted into each segment. The strength properties of the paper were increased normally. Because the property of bamboo fiber was included with ipomeas, but this increment is a normal increment and not more than blending after beating and blending before the beating process. The actual reason is that the bonding between chips during the blending process is not too strong.

**In the context of blending after beating:** The strength properties of ipomoea were measured after 10% bamboo was inserted into each segment. The strength properties of the paper were increased marginally. Because the property of bamboo fiber was included with ipomeas, but this increment is a marginal increment, not more than the blending before the beating process. The actual reason is that the bond formed by the blending of bamboo and ipomeas becomes strong enough to withstand chip blending but not so strong as to withstand blending prior to the beating process.

**In the context of blending before beating:** The strength properties of ipomoea were measured after 10% bamboo was inserted into each segment. The strength properties of the paper were significantly increased. Because the property of bamboo fiber was included with ipomeas, this increment is a strong increment to other processes. Due to strong chemical bond between bamboo and ipomeas fiber a strong increment appears to other processes.



Table 2: Blending Impact on the Brightness and Porosity

Bamboo (%)	Ipomoea (%)	<i>Brightness and porosity</i>	
		<b>Brightness</b>	<b>Porosity</b>
0	100	84.05	0
10	90	84.11	1
20	80	83.45	5
30	70	83.76	9
40	60	83.71	17
50	50	83.35	25
60	40	82.91	25
70	30	82.75	51
80	20	82.71	55
90	10	82.55	65
100	0	81.05	100

According to this research work study of bamboo and ipomoea flower proves to a principal statement that is mentioned below:

“if the percentage of the ipomoea is decreasing in the bamboo percentage than porosity of the paper increasing while the percentage of the ipomoea is increasing in the bamboo percentage than porosity of the paper decreasing”.

## Results and Conclusion

1. According to the data observation of this research work, fibrous material can be blended into three types. The strength property of the paper increased after the fibrous blend. Because the property of bamboo fiber was included with ipomeas, this increment is a normal increment and not more than blending after beating and blending before the beating process.
2. According to this research work, the study of bamboo and ipomoea flowers proves the principal statement that “if the percentage of the ipomoea is decreasing in the bamboo percentage, the porosity of the paper is increasing, while the percentage of the ipomoea is increasing in the bamboo percentage, the porosity of the paper is decreasing.”

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