



Research Article

DEVELOPMENT OF NON-WOVEN FILTER FOR 3 LAYER MASK FROM BAMBOO/POLYPROPYLENE FIBERS

Kanchana Devi S *, Rajkumar G

Department of Fashion Technology, Kumaraguru College of Technology, Coimbatore, Tamil Nadu, India

*Corresponding Author Email: kanchanadevi.19mat@kct.ac.in

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ABSTRACT

The necessary element of non-public protecting instrumentation is mask. Mask is most necessary in pandemic as a result it safeguard our life by stopping the spreading of the Corona virus by entrapping the droplets from the corona affected person to enter wearer's nose. There are different typed of mask like non- woven mask, reusable mask, N95 mask and artifact mask etc. Majority of business masks are non-woven masks that are created from polypropylene fiber. The most downside of non-woven masks is its discomfort and affect lack of breathability. This drawback is solved by utilizing natural fibers collectively of the material in non-woven and victimization them in mask. Bamboo fiber may be a natural celluloid fiber having smart comfort properties with antimicrobial properties. Bamboo fiber is also hydroscopic, natural deodorizer and hypoallergenic which provides good breathability and comfort. The polypropylene fiber is used with bamboo to provide good strength and abrasion property. Hence an attempt is made to develop a surgical mask from bamboo fiber with different blend ratios of 70:30, 60:40 and 50:50 of Bamboo and Polypropylene fiber to judge its mechanical properties like GSM and thickness potential as a protecting barrier material in non-woven face masks. The developed non-woven fabric of different blend is compared with each other, and the results shows 50: 50 blend has good mechanical properties, and the results show an effective value of Bacterial Filtration efficiency and Differential Pressure which are the most important parameters to predict the filtration efficiency of a surgical mask.

Keywords: Breathe ability, face mask, bamboo fiber, polypropylene fiber, comfort, differential pressure, bacterial filtration efficiency

INTRODUCTION

Globally, there is a huge demand for Personal Protective Equipment (PPE). PPE protects the person in opposition to health/protection dangers at work. PPE include items such as safety helmets, gloves, mask, high-visibility clothing and so on. Normally raw material used for PPE are polypropylene fibers. The polypropylene fibers are synthetic fiber which are non-biodegradable. So PPE developed from polypropylene fibers has different drawback like lack of breath ability and odor/smell. ¹Bamboo has the fastest increase rate among the numerous sorts of renewable natural fibers. The cellulose fibers in bamboo are aligned alongside the period of the bamboo providing maximum tensile strength, flexural strength, and anxiety in that direction even though bamboo is abundantly available in most of the tropical countries it has not been exploited to its potential as a reinforcing agent. So that to improve the comfort properties and reduce the polypropylene content, the addition of natural fiber like bamboo can be used.

Hence a paper has been made in this paper about bamboo and polypropylene fibers in development of face mask. Also, the various mechanical, chemical, and biological approaches for the preparation and separation of bamboo fiber reinforced with polypropylene has also been discussed.

Literature Review

Bamboo/polypropylene blend needle punching non-woven fabric were used. The study tensile properties of bamboo /polypropylene blend needle punching non-woven fabric were analyzed². The study of bio degradable mask designed for protection of

respiratory system that meets the requirements of protection standards³. Bamboo fiber are elastic, bacteriostatic, antifungal, antibacterial, hypoallergenic, hydroscopic, natural deodorizer, proof against ultraviolet light, and biodegradable which render the bamboo fiber merchandise environmentally friendly⁴. In household use of masks is associated with low adherence and is ineffective in controlling seasonal ILI. If adherence were greater, mask use might reduce transmission during a severe influenza pandemic⁵. Synthetic antimicrobial agents are effective they have side effects. In antimicrobial textiles based on ecofriendly property of fabric is an important parameter for applications such as health and hygiene⁶. Needle-punched nonwovens were used for the pre-filtration stage, highly effective melt-blown nonwovens for main filtration⁷. Natural cellulose fibres have received increasing attention because of their biodegradability and renewable resources in comparison to synthetic fibres⁸. Bamboo fibers have unique properties such as excellent appearance and feel, natural antibacterial, UV-shielding and moisture-controlling characteristics. Hence bamboo fibers provide a very promising alternative to other natural fibers⁹. Bamboo textile merchandise are having excessive needs with inside the market. Bamboo is an antibacterial; relatively smooth fibre with low pilling and wrinkling, as well as high moisture sweat absorption, due to the micro gaps in its profile¹⁰.

MATERIALS AND METHODS

Sourcing of Bamboo Fibre from pallavaa groups, Erode. It is recycled cellulose fibre made from bamboo pulp. It have natural property of anti-bacterial and odour proof. Sourcing of polypropylene fibre sourced from Jogani reinforcement, Maharashtra. Polypropylene fibre are generation fibre specially

design for construction of mask this fibre control shrinkage.

Table 1: Physical Properties of Bamboo fiber

Fibre Properties	Bamboo
Fibre denier	1.2 D
Fibre length	38mm
Dry(g/tex)	34.3
Elongation	16%
Handle	Softer than cotton
Hydroscopic nature	Absorbent
Moisture Regain %	13%
Fibre density	1.3



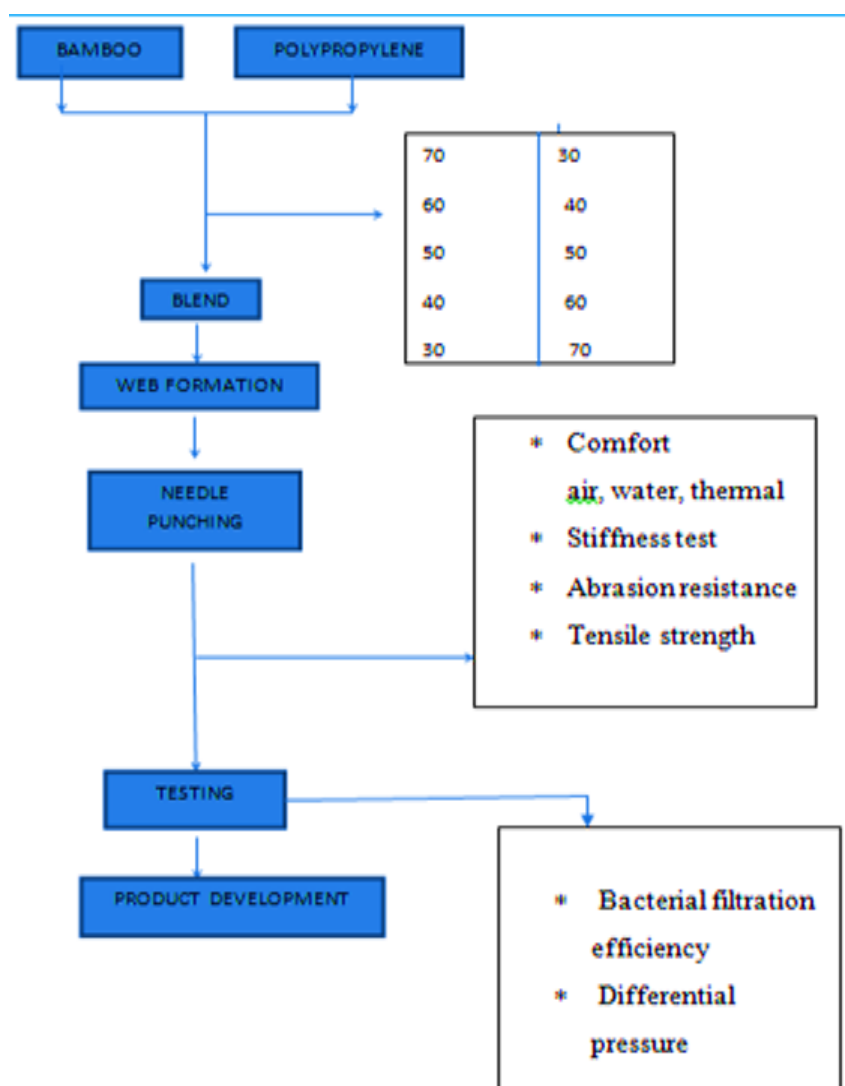
BAMBOO FIBER

Table 2: Physical Properties of Polypropylene

Fibre Properties	Polypropylene
Tensile strength	3.5
Elongation	40 to 100%
Abrasion resistance	Good
Moisture absorption	0 to 0.5
Melting point	165
Thermal conductivity	6.0



POLYPROPYLENE



The purchased fibre are bamboo and polypropylene convert into web formation using in combed machine. Then it insert into fusing machine for equalizing the web it remove extra hairs in fusing machine. After fusing needle punching process have to be done needle punched non-woven are felt like and very flexible having a fibrous network with distinctive pores, it stable for application.

PROPERTIES OF BAMBOO

Durability

To improve the durability of bamboo fiber and to provide high strength, the bamboo fiber is reinforced with polypropylene. Bamboo fiber strengthen polypropylene composite has high fatigue resistance results in its extreme durability.

Elasticity

When external layer of bamboo is expelled, specific gravity is brought down and thus elasticity decreased. When bamboo fiber steam is exploded into poly lactic acid matrix, it is observed to have high elasticity. There is decrease in modules of flexibility between longitudinal and transverse heading, the modulus of flexibility of longitudinal heading is 16.1pa.

Elongation

Bamboo when treated with caustic pop of distinctive concentration appear significant decrease in percent prolongation at break with increment in concentration of caustic soda.

Hardness

The hardness of bamboo lower because of steaming treatment. Tangle micro-fibrillate cellulose fiber when include to poly lactic acid/bamboo fiber composite, increment the hardness, and anticipate break improvement, bamboo 23% harder than oak and 13% harder than shake maple.

APPLICATION OF BAMBOO FIBER

Bamboo textures are made by unadulterated bamboo fiber yarn, which have great damp penetrability, dampness vapor transmission property, delicate hand, way better drapery, simple passing on impressive color. It could be a recently established, extraordinary imminent green texture.

Bamboo Used in Apparel

It includes sweaters, bath-suit, mat, cover, towel have comfy hand, extraordinary gloss and shining color, nice water absorbance. Bamboo fiber has such a sole work as against microscopic organism that is suitable to make consumer goods tight tee shirt and socks. Its anti ultraviolet nature is suitable to make summer consumer goods significant for the reassurance of pregnant ladies and youngster from the injured of bright radiation.

Bamboo sterile Material

In this material have gauze, cover, surgical dress, medical caretaker wear so on. The bamboo fiber has traditional impact of

sterilization and medical specialty during this manner it's particularly wide nearer read on application in sterile cloth as sterile tower, material cowl, permeable cushion and nourishment pressing so on.

Developing Material

Bamboo has sure qualities because of that it is used for development purpose. These qualities incorporate its hardness and light-weight bamboo development area unit solid and safe to soil tremors.

RESULT AND DISCUSSION

Basically, two types of tests to be done for mask.

Differential Pressure

The Differential Pressure (DP) is a test that measures how easily air is passed from one side of the mask to the other. This indicates how easily the wearer can breathe through the mask.

Sample tested at: R.H.65%+/- 2%

TEMP: 21 DEGREE C +/-1 DEGREE C

DIFFERENTIAL PRESSURE TESTED IN EN 14683: 2014 (E) Annex C
Pa/cm2 – 12.302

Measured differential pressure test of Pa/cm2.302 required value <29.4

Bacterial Filtration Efficiency

TEST METHOD ASTM F 2101

ASTM F 2101 Bacterial filtration efficiency	02100026-1 Filtration of mask in bamboo and polypropylene
Test organism used	Staphylococcus ATCC 6538
Inoculum size	5*10 ⁵ CFU/mL
Media used	Tryptic soya sugar
Dilution Medium used	Peptone Water
Incubation Conditions	37°C for 24 h
Area of test specimen	Face mask 10*10 cm
Sample exposure side	Face side
Flow rate of aerosol	28.5L/min
Mean particle size of challenging aerosol	3.0±0.3 micron
Average plate count of positive control	1798
Average plate count of negative control	0
BFE of test specimen	88.8

Bacterial Filtration Efficiency value for actual required mask 83.4 – 85.5 for this mask 88.8% of filtration efficiency is present.

Bacterial filtration efficiency is a measurement of a respirator material resistance to penetration of bacteria. Report as percent efficiency and correlate with ability of the fabric to resist bacterial penetration. Higher number in this test indicate better barrier efficiency.



FRONT SIDE



BACK SIDE

CONCLUSION

It is complete from this paper that bamboo fiber has high potential ability in non-woven producing and utilize them as a stuff in mask. The bamboo fiber area unit been employed in several application of medical textile thanks to its wonderful natural anti-microbial property. The fiber additionally acts as an honest thermal insulation and its bio- degradable. This kind of fibre once bolstered with polypropylene, the strength and sturdiness of the material is accumulated and additionally passes smart barrier property a smart breath ability that is needed for a mask an additionally surgical mask have 83.8-85.5 you look after differential pressure check of pa/cm12.302 needed worth<29.4 of air worth. In microorganism filtration potency. This paper I conclude once a fibre mix mask offers high breath ability with smart barrier properties. In bamboo fiber have smart breath ability so we tend to like a mask in fibre.

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