Comparative study of Comfort properties of union Woven fabrics: Cotton, Bamboo, Viscose and Modal for Kids wear

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Abstract

The objectives of the present research work are to develop the Union Fabrics for kids wear having the 100% Cotton (2/50) in warp and 100 % Bamboo (1/30), 100 % Modal (1/30), 100 % Viscose(1/30) and 100 % Cotton(1/30) in weft and find out the most comfortable fabric in terms of Comfort properties i.e. Air permeability and vertical wicking of union fabrics with cotton yarn as warp and yarn from regenerated fibers (Viscose, Bamboo and Modal) as weft having properties similar or better than 100% cotton. Twill weave is used for fabric structure. Subjective assessment of the developed kids wear were done using questionnaire for the respondent. From the survey it was observed that 36%, 29%, 21% and 14% respondent were satisfied with Cotton-Modal, Cotton-Bamboo, Cotton-Viscose and Cotton-Cotton garments respectively.

Keyword

Comfort, Wicking, Air Permeability, Cotton, Viscose, Bamboo, Modal, Warp, Wefts, Porosity, Moisture Regain, Cover Factor, GSM and Thickness.

Introduction

The days are gone when kids used to wear everything and anything that their parents used to choose for them. Now kids always want to be dressed in fashionable clothes as they want to be a fashionable kid. They want to be dresses in attires of their own choice and have their own favorites [(1)]. Kids wear has a lot of variety which includes kids fashion clothing, kids nightwear, kids readymade garments, kids rompers, kids tops, kids knitted wear, kids winter clothing, kids summer clothing, organic clothing. It is important for parents to encourage creative choices, it is always better for a kid to choose style they feel comfortable as they desire to attract the attention of kids of their age .They want to choose their clothing from designer collection for kids[(2)]. Always encourage child to choose colors and style they like, as opposed to setting for what.

There are a couple of things one needs to keep in mind when shopping for kids. Fabric plays a very important role before you decide to pick a particular dress. Kids are comfortable in certain fabrics and as a mother you will get to know the likes and dislikes of the child pretty soon [(2)]. Fabrics like cotton, chiffons and silks are preferred by most kids as they are light, comfortable and airy. Only when they are comfortable with the dress they are wearing will they be happy outside. Dresses should also be selected based on the season. For summer season, it is better to go with cotton and chiffon clothes. Fabrics like these will make them feel comfortable. Cotton dresses can absorb more sweat thereby keeping the baby cool and at ease. It is imperative that the parent chooses a dress which is both comfortable as well as elegant [(3)]. For a special occasion the dress needs to be classy and elegant but at the same time comfortable as well. This will give room for kid's skin to breathe and make her less cranky. Make sure that nothing sharp or prickly touches kid's skin which would otherwise give her an aversion towards dresses. So this research is used to provide new variety in union fabrics collection for kids wear like modal, viscose and Bamboo [(4)].

MATERIALS AND EXPERIMENTAL METHODS

Three union fabrics were developed using 100%Cotton yarn as warp and 100% weft yarn made from Modal, Bamboo and Viscose fibers. In order to compare the above union fabrics with the fabrics that are widely used as kids wear, another set of fabrics were prepared using 100% cotton yarn as warp and weft.

Weaving Parameters

The specifications of weaving machine and fabrics used are as follows:

Loom: Sample power loom, over pick with Dobby

Speed (rpm): 120

Woven fabrics with the following specifications:

Table 1 Specifications of fabrics used

Warp Yarn	100% Cotton
Weft Yarn	100% Cotton, 100% Bamboo, 100% Viscose, 100% Modal
Weave	Twill weave (2/1)

EPI	84
PPI	72
Warp count	2/50 Ne
Weft count	1/30 Ne
Fabric weight	150 g/m^2

RESULTS AND DISCUSSIONS

Results and Discussions

This chapter mainly deals with results obtained on the series of testing carried out on the prepared fabric samples under study and discus the factors that are highly influence the properties of the product.

Table 2 Comparison of yarn test values

Yarn	*Count(Ne) (actual)*	*Count strength product(CSP)*	*Twist per inch(TPI)*	*Hairiness (No. of fibers per 200m)*	*Uster Uneveness*	*No. of fibers in yarn cross-section*
Modal(1/30)	29.78	2925.88	16.12 ‘s’	13.22	0.80	598.82
Bamboo(1/30)	30.14	2293.47	16.04 ‘s’	11.20	1.19	701.58
Viscose(1/30)	28.69	2203.23	15.50 ‘s’	30.17	2.17	749.41
Cotton(1/30)	29.98	2617.96	16.08 ‘s’	18.63	1.54	761.81
Cotton(2/50)	24.38	2751.55	25.37 ‘z’	9.71	1.19	914.18

Table 3 Comfort properties (Air permeability, Porosity and Vertical Wicking values) of grey and scoured fabric

Fabric types	*Air permeability (m^3/m^2/min.) Scoured fabric*	*Porosity (%)*		*Vertical Wicking (inches) Scoured fabric*
		Grey	**Scoured**	
Cotton-Modal	100.85	72.5%	80%	5.6
Cotton-Bamboo	91.01	71.7%	73%	4.5

Cotton-Viscose	86.76	69.2%	70.6%	2.4
Cotton-Cotton	74.18	65.2%	67%	1.5

Air permeability

Effect of fiber type on Air permeability of scoured fabrics

Table 4 Air permeability values of scoured fabrics

Fabric types	***Air permeability ($m^3/m^2/min.$)***
Cotton-Modal	100.85
Cotton-Bamboo	91.01
Cotton-Viscose	86.76
Cotton-Cotton	74.18

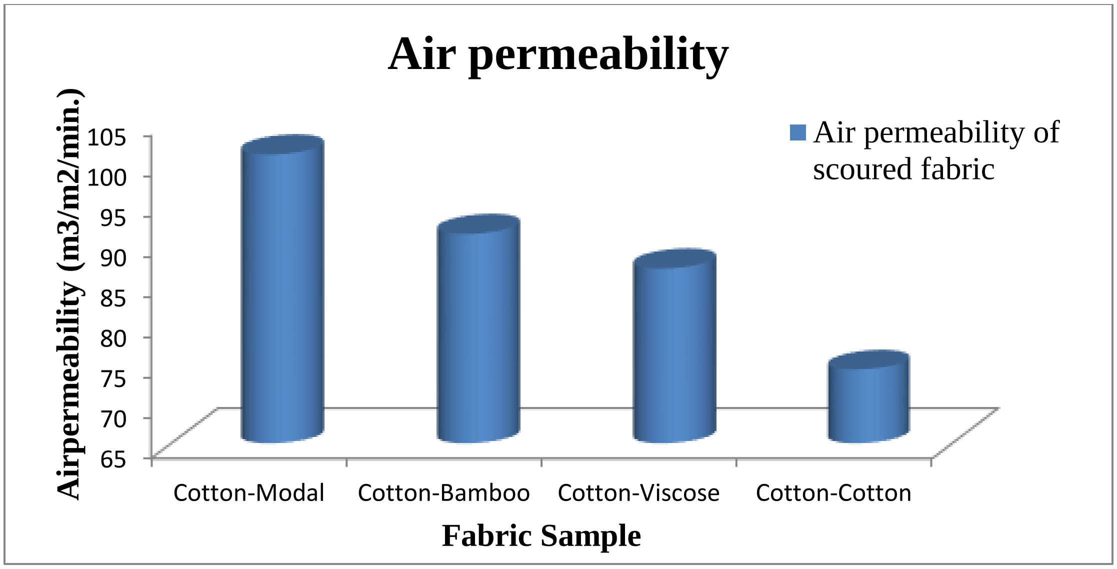

Fig.1 Air permeability of scoured fabrics

The results in Table 4 and Fig.1 show that Cotton-Modal fabric exhibits the highest value of air permeability while Cotton-Cotton fabric shows lowest value and the other two fabrics i.e. Cotton-Bamboo and Cotton-Viscose exhibits intermediate values. Air permeability also depends upon porosity and numbers of pores per unit area. With the increase of pores per unit area as well as porosity, air permeability increases [5].Cotton-Modal fabric shows the highest value of porosity as compare to other three fabrics that's why Cotton-Modal fabric shows highest air permeability [34]. Similarly air permeability also depends on fabric cover factor. More the cover factor less is air permeability or vice-versa. Fabric cover for Cotton-Cotton fabric is highest than the other three fabrics therefore air permeability of Cotton-Cotton fabric is less [6]. Number of fibers in yarn cross-section also affects the air permeability value with the increase in number of fibers in yarn cross-section, air permeability value decreases or vice versa. As Cotton-Cotton fabric is having more number of fibers in yarn cross-sectiontherefore air permeability is less [7].Hairiness also affects air permeability more the protruding hairs on yarn surface less is the air permeability. As Modal yarn having less hair on yarn surface, Hence, Cotton-Modal fabric shows highest air permeability [8]. The increased value of air permeability for Cotton-Modal fabric as compared to other fabrics is due to the fact that Cotton-Modal fabric is having lowest value of thickness as well as the fabric GSM [9]. As thickness and GSM decreases, air permeability increases.From the statistical analysis it was observed that there is a significant difference in air permeability values of all the experimental fabrics (ANOVA report can be seen from annexure A.1).

Vertical Wicking

Effect of fiber type on Vertical Wicking of scoured fabrics

Table 5 Vertical Wicking values of scoured fabrics

Fabric types	*Vertical Wicking(inches)*
Cotton-Modal	5.6
Cotton-Bamboo	4.5
Cotton-Viscose	2.4
Cotton-Cotton	1.5

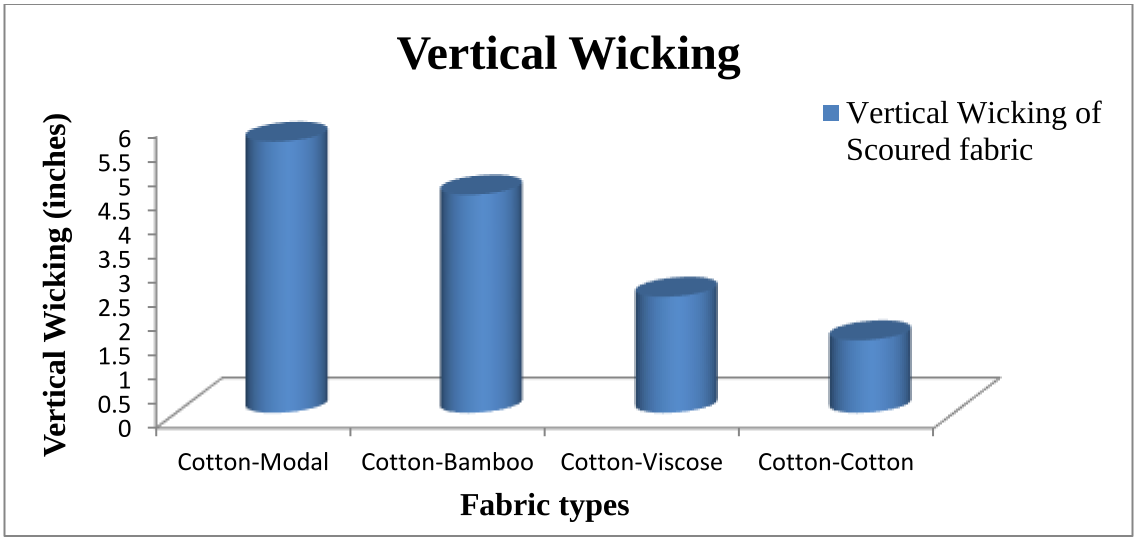

Fig.2 Vertical Wicking of scoured fabrics

It is evident from Table 5 and Fig. 2 that Cotton-Modal fabric exhibits the highest value of wicking while Cotton-Cotton fabric shows lowest value and the other two fabrics i.e. Cotton-Bamboo and Cotton-Viscose exhibits intermediate values of vertical wicking. Vertical wicking is directly proportional to porosity, as the porosity increases vertical wicking increased. Cotton-Modal fabric shows highest porosity as compared to other three fabrics that is whyCotton-Modal fabric shows highest vertical wicking [(9)].The moisture regains is also responsible for the wicking property of fabric, more the moisture regains more will be the wicking of fabric [(10)]. Moisture regain for Cotton fibre is lowest as compared with other fabrics, hence wicking is lowest for Cotton-Cotton fabric. Similarly vertical wicking also depends on fabric cover factor. More the cover factor less is vertical wicking or vice-versa [(12)]. Fabric cover for Cotton-Modal fabric is lowest than the other three fabrics therefore vertical wicking of Cotton-Modal fabric is highest. As the thickness and GSM decrease vertical wicking increases or vice-versa. Thickness and GSM was found to be lowest for Cotton-Modal fabric as compare to other three fabrics that is why Cotton-Modal fabric shows highest vertical wicking [(11)]. With the help of statistical analysis using sigma plot software it is found that the difference in the mean values of vertical wicking is statistically significant(statistically significant one way ANOVA report can be seen from annexure A.2).

Conclusion

- Cotton-Modal fabric shows maximum values of air permeability and vertical wicking property where as Cotton-Cotton fabric shows minimum values of air permeability and vertical wicking whereas Cotton-Bamboo and Cotton-Cotton fabric show minimum values of above properties for kids wear, women wear and men wear.

Further studies can be made in the following areas

- Different weave combinations can be taken for optimizing the fiber and fabric properties.
- Varying linear density can be utilized to see the effectiveness of yarn count on comfort properties.
- Different chemical finishes can be applied on the union fabrics made of Cotton-Modal, Cotton-Bamboo and Cotton-Viscose to improve comfort properties for kids wear, women wear and men wear.
- Varieties of union fabrics can be developed by using different blend % of Modal, Bamboo and Viscose in warp and weft directions.

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Annexure A.3

One way anova test results of Air Permeability

One Way Analysis of Variance
Data source: Data 1 in Notebook2

Normality Test (Shapiro-Wilk) Passed (P = 0.871)

Equal Variance Test: Passed (P = 0.438)

Group Name	N	Missing	Mean	StdDev	SEM
C-M air	10	0	100.850	2.982	0.943
C-C air	10	0	74.180	1.984	0.627
C-B air	10	0	91.00	1.836	0.581
C-V air	10	0	86.760	1.710	0.541

Source of Variation	DF	SS	MS	F	P
Between Groups	3	3625.604	1208.535	252.795	<0.001
Residual	36	172.105	4.781		
Total	39	3797.709			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Holm-Sidak method):
Overall significance level = 0.05

Comparisons for factor:

Comparison	Diff of Means	t	P	P<0.050
C-M air vs. C-C air	26.500	27.101	<0.001	Yes
C-B air vs. C-C air	16.880	17.263	<0.001	Yes
C-M air vs. C-V air	13.920	14.236	<0.001	Yes
C-V air vs. C-C air	12.580	12.865	<0.001	Yes
C-M air vs. C-B air	9.620	9.838	<0.001	Yes
C-B air vs. C-V air	4.300	4.398	<0.001	Yes

Annexure A.2

One way anova test results of Vertical Wicking

One Way Analysis of Variance
Data source: Data 1 in finished 2

Normality Test (Shapiro-Wilk) Failed (P < 0.050)

Equal Variance Test: Failed (P < 0.050)

Group Name	N	Missing	Mean	StdDev	SEM
C-M wicking	10	0	5.600	0.760	0.240
C-C wicking	10	0	1.500	0.275	0.0869
C-B wicking	10	0	4.500	0.780	0.247
C-V wicking	10	0	2.440	0.337	0.107

Source of Variation	DF	SS	MS	F	P
Between Groups	3	105.332	35.111	102.066	<0.001
Residual	36	12.384	0.344		
Total	39	117.716			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Holm-Sidak method):
Overall significance level = 0.05

Comparisons for factor:

Comparison	Diff of Means	t	P	P<0.050
C-M wicking vs. C-C wicking	4.100	15.631	<0.001	Yes
C-M wicking vs. C-V wicking	3.160	12.047	<0.001	Yes
C-B wicking vs. C-C wicking	3.000	11.437	<0.001	Yes
C-B wicking vs. C-V wicking	2.060	7.854	<0.001	Yes
C-M wicking vs. C-B wicking	1.100	4.194	<0.001	Yes
C-V wicking vs. C-C wicking	0.940	3.584	<0.001	Yes