

# DEVELOPMENT AND CHARACTERISATION OF SANITARY NAPKINS WITH LYOCELL / MODAL AS ABSORBENT CORE

Dr.M.Dhinakaran<sup>1</sup>, C.S.Senthil kumar<sup>2</sup>,<sup>3</sup> Dr.T.Sathis kumar

<sup>1</sup> Senior Associate Professor, Department of Textile Technology, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

<sup>2</sup> Associate Professor, Department of Fashion Technology, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

<sup>3</sup> Senior Associate Professor, Department of Textile Technology, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

-----\*\*\*-----

**Abstract** - Wood pulp is a major raw material used in the absorbent core of hygiene products like diapers, tampons, sanitary napkins and incontinence, all of which have a great share of market in the medical textiles. This wood pulp is from natural wood source got by destroying trees leading to deforestation and adverse environmental effects. The main objective of this project is to develop an alternative for wood pulp. The study focuses on the development and characterization of sanitary napkins made from regenerated cellulose fibres like Lyocell and Modal. Lyocell is chosen for its superior softness, absorbability, strength and wickability which are better than all other cellulosic and regenerated fibres; Modal chosen for its dimensionally hygroscopic nature i.e. absorbs 50% more water than cotton and reduced growth of bacteria when compared to cotton. These alternate absorbent cores from regenerated cellulose are compared with wood pulp.

Commercially acceptable brands of sanitary napkins have been tested for their dimensional and performance characteristics like antimicrobial test, absorption, liquid strike – through, liquid retention etc. They were analyzed for the best performing parameters and used as standards for developing the napkins using the selected regenerated fibres. Various types of napkins were done by varying the fiber compositions (100 % of Lyocell, 100 % of Modal fiber – 2 variations of sanitary napkins).

**Key Words:** Wood pulp, Sanitary napkin, Modal, Lyocell fibre, Blended material

## 1. INTRODUCTION

Today in the era of eco – friendly environment, it has become very important for human beings to live in the world of hygiene and freshness. The awareness of health and hygiene of consumers, has increased the demand for antibacterial textiles and has two functions – one protecting the wearer, and the second ensuring biodegradation of the textile material. An important area of textiles is the healthcare and hygiene sector among other medical applications. The range of products includes disposable and non- disposable items such as surgical gown, mask, surgical drapes, towels, gloves, baby diapers, sanitary napkins and so on used in hospitals. Sanitary napkins are designed to absorb and retain menstrual fluid discharges. Main requirements of sanitary napkins are absorbency and retention of menstrual fluid, stop leakages, aesthetic appearance, prevent odour, stay in place, and provide with a feel of comfort. Not only must the sanitary napkins provide comfort and safety, but also enhance every woman's health and lifestyle. This study focuses on finding out an alternative material for the currently used absorbent core, that is wood pulp. The two regenerated fibres, namely, Lyocell and Modal have been selected as absorbent core owing to their fusion of properties of natural fibres (absorbency) and that of synthetic fibres (strength).

## 2 MATERIALS

**2.1 Lyocell:** - Lyocell is chosen for its superior softness, absorbency, strength and wickability which are better than all other cellulosic and regenerated fibres. Lyocell is easy care, dyes well, and has good wicking properties so it is breathable. It is totally biodegradable and can be recycled.

**2.2 Modal:** - Modal chosen for it is a new regenerated cellulosic, dimensionally stable and do not shrink or get pulled out of shape. It is more hygroscopic in nature i.e. absorbs 50% more water than cotton and has reduced growth of bacteria when compared to cotton.

### 3. METHODS

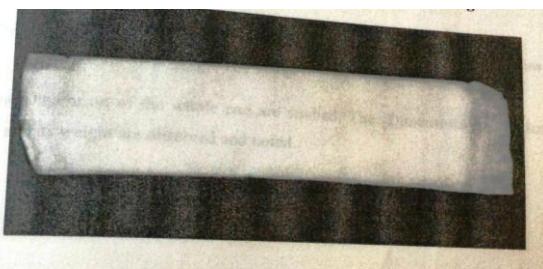
#### 3.1. Evaluation of the Branded Sanitary Napkin available in the Market:

Normal varieties of sanitary napkins of 3 major brands (Stayfree, Whisper & Kotex) have been selected for study and the physical parameters tested were:

- Product Dimension
- Liquid strike through test
- Wet back
- Absorption
- Disposability
- Determination of absorbency & ability to withstand Pressure after Absorption

#### 3.2 Design of comfortable and breathable sanitary napkins with Lyocell and Modal as absorbent core.

- Materials
- Measurement of Lyocell and Modal fibre properties
- Assessment of antibacterial activity by bacterial test
- Selection of retention layer
- Selection for absorbent core  
Sanitary Napkin making



**FIG1** - Sample Sanitary Napkin

### 4. RESULTS AND DISCUSSIONS

#### 4.1 Comparison of the test results of commercial and developed Sanitary Napkins:

##### 4.1.1 Product dimension:

The dimension of 3 Branded napkins and its components have been studied.

**Table 1:** Whole pad dimension with wings of Branded Napkins

S. No	Sample	Average size, cm <sup>2</sup>	Average Product Thickness, mm	Average weight, gm
1	Brand 1	20*15	6.80	7.58
2	Brand 2	23*15	6.82	8.28
3	Brand 3	22*13.5	8.30	9.84

**Table 2:** Wood Pulp dimension of Branded Napkins

S. No	Sample	Average size, cm <sup>2</sup>	Average Product Thickness, mm	Average weight, gm
1	Brand 1- WP	20*6	4.75	4.9
2	Brand 2- WP	20.1*6.5	4.25	5.4
3	Brand 3- WP	20*6	4.2	6.59

**Table 3:** Whole pad dimension of prepared Sample Napkins

Parameter	Lyocell	Modal	Modal/Lyocell (50/50)
Average size, cm <sup>2</sup>	21*9	21*9	21*9
Average Product Thickness, mm	8.30	8.21	8.25
Average weight, gm	14	14	14

Thus the developed sanitary napkins have more thickness and weight as it has more absorbent fibre fluff stuffed in order to replace the absorption of gel used in the commercial napkins.

##### 4.1.2 Measurement of Modal and lyocell fibre Properties

**Table 4:** Properties of Lyocell and Modal fibres

Property	Modal Fibre	Lyocell Fibre
Moisture Content %	8.28	9.465
Moisture Regain %	11.8	12
Fineness, dtex	8	13
Tenacity, cN/tex	2.2 to 4 dry ; 3.8 to 5 wet(GPD)	37
Elongation %	7% - dry ; 8.5% - wet	13

**Table 5:** Comparison of Lyocell, Modal and Modal/Lyocell (50/50)

Sanitary napkin S-1 shows best result as compared to S-2 and S-3

Sample details	S-1 Lyocell	S-2 Modal	S-3 Lyocell/Modal
Liquid strike through time sec (ISO 9073-8)	1.95	3.8	6.2
Wet back grams (ISO9073-14)	0.49	0.20	0.25
Free swell absorption capacity (WSP 240.2)	30.82	20.21	22.43
Absorbency under pressure (WSP 243.2)	Pass	Fail	Fail

The properties of lyocell and modal fibres are given in Table.4. It can be observed that the moisture content and regain of lyocell fibre is 9.86% and 12 % respectively. It is greater than modal. Thus this property enhances the absorbency of fluid rapidly. Further the tenacity of lyocell is greater than modal. In addition, both are microfibers; they are good in softness, breathability and cool to wear.

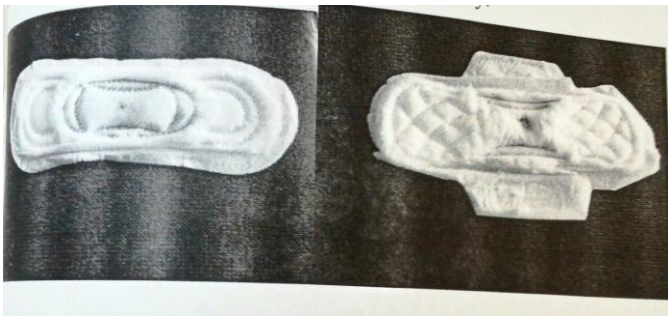


FIG 2 - Brand 1

FIG 3 - Brand 2



FIG 4 - Brand 3



FIG 5 -Modal

FIG 6 - Lyocell



FIG 7 - Both blend (50/50)

## 5. CONCLUSION

The study has proved the effective replacement of wood pulp and other cellulosic fibres with the proposed new absorbent core material from regenerated cellulose for developing feminine hygiene products. Absorption capacity and wickability are highest for Sanitary Napkins made of Lyocell

and Modal/ Lyocell blends of both 50/50 proportions. Liquid strike - through time is lowest for the Sanitary Napkins made of Lyocell and Modal/ Lyocell blend (50/50). Thickness of sanitary napkins made of Lyocell is lesser than that Modal/ Lyocell blend (50/50). Antibacterial activity of Lyocell is higher than Modal/ Lyocell blend (50/50) and 100% modal. Sanitary Napkins made of Lyocell and Modal/Lyocell (50/50) blend performs well with regard to absorption capacity, wickability, liquid strike - through time, thickness and antibacterial activity. Hence there is good scope for use of these materials as absorbent core in the sanitary napkins instead of the currently used wood pulp. These materials are more eco-friendly and sustainable when compared to the wood pulp.

## REFERENCES

- [1] Hongyi Liu, Yong Zhang, and Juming Yao : Preparation and Properties of an Eco-friendly Superabsorbent Based on Flax Yarn Waste for Sanitary Napkin Applications *Fibers and Polymers* 2014, Vol.15, No.1, 145-152.
- [2] O L Shanmugasundharam : Development and characterization of bamboo and organic cotton fibre blended baby diapers, *Indian Journal of Fibre & Textile Research* ,Vol. 35, September 2010,pp.201-205.
- [3] A. Das, V. K. Kothari, S. Makhija, K. Avyaya : Development of High-Absorbent Light-Weight Sanitary Napkin, *Indian Institute of Technology, New Delhi-110 016, India.*
- [4] Development of Sanitary Towel Using Locally Available Natural Fibres for Marginalised Groups in Kenya Githinji DN\*, Githaiga JT, Odhiambo SA, Chemweno P Department of Manufacturing, Industrial & Textile Engineering, Moi University, P.O. Box 3900, Eldoret, KENYA
- [5] A Mathematical Model for Diffusion and Exchange Phenomena in Ultra Napkins ,Joachim Weickert , University of Kaiserslautern. Laboratory of Technomathematics, P.O. Box 3049, D- W-6750 Kaiserslautern. Germany, Communicated by H. Neunzert.
- [6] Development of High-Absorbent Light-Weight Sanitary Napkin, A. Das, V. K. Kothari, S. Makhija, K. Avyaya ,Department of Textile Technology, Indian Institute of Technology, New Delhi-110 016, India Received 7 July 2006; accepted 16 April 2007 , DOI 10.1002/app.26936 ,Published online 12 October 2007 in Wiley InterScience (www.interscience.wiley.com).
- [7] Moisture Absorption Characteristics of Natural Fibre Composites, J. GtRIDHAR, KISHORE AND R. M. V. G. K. R- \O\* Depar-trTu:nlof Metallurgy, Indian Insrirute of Science ,Bangalore-560 0/2, India, (Rccc:i\~cdJune 9. ,1985)
- [8] Preparation and Properties of an Eco-friendly Superabsorbent Based on Flax Yarn Waste for Sanitary Napkin Applications ,Hongyi Liu , Yong Zhang and Juming Yao.
- [9] A comparative study of sanitary napkins and absorbent nappy pads for urine output measurement in neonates , Sourabh Dutta (sourabhdutta@yahoo.co.in), Shiv Sajjan

Saini, Anil Narang, Division of Neonatology, Department of Pediatrics, Postgraduate Institute of Medical Education and Research, Chandigarh, India.

- [10] Mechanical properties of natural fibre reinforced polyester composites: Jowar, sisal and bamboo, A.V. Ratna Prasad <sup>†</sup>, K. Mohana Rao, Department of Mechanical Engineering, V R Siddhartha Engineering College, Vijayawada 520 007, A P, India.