

Development of low cost Sanitary Napkins: Breaking MHM taboos of women in India

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ABSTRACT

The sanitary protection used during menstruation determines the hygiene and health status of a woman. Besides hygiene and health, availability of sufficient and appropriate menstrual materials also ensures dignity and mobility for a woman during menstruation. Many brands of sanitary napkins are available in the Indian market, but due to their high cost these products are being utilized mostly by the upper middle and high-income group women. Women of the lower income category have no option but to use old cloth rags during menstruation (Bhardwaj and Patkar, 2004). In a sanitary napkin the middle layer is the key component which absorbs and retains the fluid, and determines the efficiency of the napkin. This absorbent layer of a napkin is a non woven web, made of hydrophilic cellulosic staple fibers, the bulk of this layer being manufactured from wood pulp, a major contributor to the overall cost of a sanitary napkin. Thus, to make sanitary napkins affordable by the women of the Lower Income Group, the development of a low cost technology for the manufacture of these products is imperative. The option to reuse indigenously available textile waste materials like cotton from knitwear waste and agro-residues like bagasse with properties suitable for making the absorbent web has been utilized and standardized in this project. The process has been optimized and evaluation of the final product has been done with respect to performance, comfort and hygiene parameters. The quality of the developed product was compared using specified parameters with four major brands of sanitary napkins in the Indian markets. The technology of manufacturing low cost sanitary napkins has been transferred to women belonging to the lower income categories. This has thus created facilities by which the low-income semi urban, rural population of India shall be benefited and can generate a good income source. Social marketing and door-to-door selling is being extended for the distribution of affordable, user-friendly sanitary products for menstrual management.

Key Words : Menstrual Hygiene Management (MHM), Sanitary protection, Absorbent web, Menstrual materials

INTRODUCTION

Menstrual management among adolescent girls and women is a social taboo in developing

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countries. It has also lacked representation in policy debates. India being no exception, menstrual management is a complex issue with deep penetrating socio-cultural roots and consequences. The social outlook implicates having periods as a shame and burden for women, and such an outlook and understanding towards menstrual cycle clearly reflects in the unhygienic and negligent practices of women in India.

A shocking picture is exposed through studies which elucidate that out of India's 355 million menstruating women only 12% use sanitary napkins while the rest 88% rely on traditional and unhygienic practices of using rejected cloth, rags etc. during menstruation¹. The women using unhealthy menstrual practices are prone to have severe gynecological consequences such as vaginal infections, skin irritations, reproductive tract infections, severe cases of maternal morbidity.

The consequences of not using sanitary napkins often have deeper socio-economic consequences ranging from disrupted marital relationships, abandonment of woman by her husband and in-laws to mental and physical torture of the woman from family and society at large. The social myths and practices regarding menstruation often compel young girls to drop out of school at the onset of puberty, sometimes as early as at the age of 10.

The principal contributors to such a dismal scenario are unawareness towards menstrual management and the outcomes of unhygienic menstrual practices and lack of availability of affordable sanitary napkins in the market. Hence a majority of the problem can be addressed through breaching the knowledge gaps, breaking the myths and taboos associated with menstruation and making the sanitary napkins available at a price affordable to the rural population of India.

There are a few studies, especially in India, which focuses on the issues related to the outcomes of unhygienic gynecological and sanitation practices on women and adolescent girls. Bhardwaj and Patkar (2004) found that sanitation issue is one of the major factors in adolescent girls' dropout from schools.

Although, the Government of India has taken an initiative in the year 2010 to provide sanitary napkins to the target community at cheaper rate with budgetary allocation of Rs 150 crore, this project has been limited to only certain parts of the country.

Local level innovations are often argued to be more environments friendly, democratic and better suited to generate alternative income opportunities².

In India, production of Sanitary Napkins is by Multinational firms using expensive machineries. Efforts have been made to develop and market simple and low cost machines which can be used in rural setup. Napkins produced using these indigenous machines are 25-30% cheaper than the lowest category napkins available in the market. The major cost is of the raw material used for absorption. There is enough scope of trying alternate material to increase efficiency and reduce cost of napkins.

Currently most of the MNCs involved in manufacturing Sanitary Napkins use pine wood pulp which is imported from various foreign countries. This wood pulp is costly and none of the organization in India produces it. Some small village level units use waste shoddy cotton which is unhygienic. Some initial research on available alternatives of wood pulp in India resulted in Bagasse pulp, water hyacinth pulp, banana stem pulp, bamboo pulp and cotton knit wear waste pulp as options. All these are indigenous materials and their availability

is in abundance across the country. These pulps are very close to wood pulp in their pulping quality and also have certain features, like bagasse have high absorbency. Similarly bamboo pulp has natural power to protect from humidity, bacteria though available in some parts of the country only. So, there is a need to do further research on raw materials according to their specific qualities, availability in local area as well as price.

No commercial efforts have been made by any organization in India for making low cost napkins from indigenous raw materials. National Mission on Bamboo Applications (NMBA) started pilot units in Nagaland and Goa for making napkin from bamboo pulp which is turned out to be expensive, "Goonj"-a NGO makes napkins from waste cloths for free distribution in lowest income groups, but there are quality concerns in their napkins.

Disposal of Napkins after use is another major concern in rural area. The Napkins produced by MNCs are not biodegradable. The Napkins produced using indigenous machines also have non biodegradable plastic protection layer. Attempts will be made to replace these plastic layers by biodegradable layer.

In a sanitary napkin the middle layer is the key component which absorbs and retains the fluid, and determines the efficiency of the napkin. This bulk layer of a napkin is a non woven web, made of hydrophilic cellulosic staple fibers like wood pulp, cotton linters, viscose etc. (IS: 5405 – 1980). Pulp is a dry fibrous material prepared by chemically or mechanically separating fibers from wood, fiber crops or waste paper. Wood is the most common material used to make pulp. Also the principal raw material used for manufacturing pulp for the absorbent layer of sanitary pads is wood. Hence the consumption of wood is increasing day by day. In reality, 10 times more forests are lost globally each year than are gained through regrowth- a net destruction of 40 million acres annually. However, global wood consumption is projected to increase by at least 20% in the year 2010 and by more than 50% by 2050 (Rajesh and Rao, 1998). The drastic rise in wood consumption propels the depletion of world's forest. Depletion of forest cover and pollution of the environment are two major concerns of mankind today. Thus there is great impetus for developing technologies that prevent the cutting down of forests, as well developing "green technologies" that reduce the quantity of chemicals used in a process. Also, most of the wood pulp being used for the purpose of developing sanitary napkins is imported, and therefore expensive. Further, the dwindling forest resources require the sector to turn to other sources of raw materials such as cellulosic waste from the textile and garment industry

Cotton is seen as a major fiber poised to replace wood pulp especially in the feminine hygiene products where 'less bulky' is preferred and 'thinner is better' (Egelsbach, 2002). The high cost of cotton is the reason why it has not been able to replace pulp. Hence, the possibility of using cotton from the low cost knitwear waste is most appropriate to achieve value at less cost. The waste of the knitwear sector is typically from fully-fashioned garments or the traditional cut'n'sew techniques. The cost of this cutting and sewing edge waste varies from Rs. 2 to 10 / Kg.

In the present study, an attempt has been made to develop low cost sanitary napkins by utilizing cotton fiber from knitwear waste and bleached bagasse pulp. The process has been optimized and evaluation of the final product was done with respect to performance, comfort and hygiene parameters. The quality of the developed product was compared using specified

parameters with four major brands of sanitary napkins in the Indian markets.

The first step of this process was to make an assessment of the need for low cost sanitary napkins amongst lower income group women. To achieve this, visits were made to three peri-urban villages in Navi Mumbai and information was collected with the help of Focus Group Discussion and Interview methods of data collection. The second step was to find out the quality standards of branded sanitary napkins. For this, sixteen varieties of four major brands of sanitary napkins were evaluated in terms of physical parameters like fiber analysis, absorbency, water retention, pH, disposability and hygiene parameters by microbiological analysis. The process of prototype development of low cost sanitary napkins started with assessment of the suitability of cotton knitwear waste and bleached bagasse pulp as materials for absorbent layer of the napkin.

The cotton knitwear material in the form of cutting and sewing edge fabrication waste was converted to fiber state using garneting technology. A garneting machine suitable for cotton fiber from hosiery waste was procured from Amroha (U.P) for this purpose. Further, these fibers were converted into a lap sheet and compacted into a form suitable to be used as the middle layer of the napkin. A suitable lap-forming machine was indigenously designed and developed based on the fiber length specifications of the cotton from knitwear waste. The final sealing of the napkin was done between the top layer (polypropylene) and barrier sheet (polyethylene) to make a regular size napkin prototype. An auto-impulse sealing machine to suit the variable melting points of the three layers was procured. The developed prototypes were sterilized in an autoclave using high temperatures. Designs of napkin prototypes were developed in three sizes varying from large, medium to small to cater to the variable flow days of a menstrual cycle. Both belted and beltless designs were made using colored and white fiber.

Bagasse is the fibrous residue of sugar cane (*Saccharum officinarum* Linn.) left after the crushing and extraction process. Normally, sugar mills use bagasse as fuel for generating steam and electrical energy.

In comparison to bamboo, bagasse has higher percentage of cellulose and lower amounts of lignin (Table 1), thereby easier to refine for pulp manufacture, giving a softer pulp of a higher absorbency. Bagasse is already used as a source of papermaking fibers in producer countries like South America and India where it represents 20% of the paper production. This material offers several advantages: rapid growth of the sugar-cane plant, lower energy and bleaching chemical requirements for bagasse refining and voluminous waste product, where one tonne of refined sugar results in two tonnes of Bagasse (Signoret, 2006). The price practiced by the local market is in the range from US\$ 3.5/tonne to US\$ 11.84/tonne, with an average value of US\$ 7.67/tonne (Filho and Badr, 2007).

Processing of the bleached bagasse pulp was done by washing, drying, disintegrating and pulverizing. Washing was done in a soapy solution of 0.5% detergent for one hour at

Table 1 : Characteristics of some common agro-residues				
Type of fiber	Cellulose %	Lignin %	Mean length (mm)	Mean width (mm)
Bamboo	26-43	21-31	2.7	0.014
Bagasse	32-37	18-26	1.7	0.02

(Source: Rajesh and Rao, 1998)

room temperature using an MLR of 1:10. Disintegration was done in the pulp disintegrator to further open up the lumps of pulp into smaller granular size. To achieve a pulp texture close to that of wood pulp used in branded sanitary napkins, pulverization of the disintegrated pulp was done in a Pulverisette.

The pulp of bagasse after pulverization was compared to that of wood pulp (of branded sanitary napkins) in terms of freeness, softness and uniformity by appearance and touch. The assessment of the pulverized pulp was evaluated in terms of brightness, pH and absorbency.

Weighed amount of the pulverized bagasse pulp was spread out evenly on a clean surface and prepared into sheets by pounding with hand. The absorbent layer thus prepared was cut into Regular size napkin webs with 8 gm pulp each (as per IS : 5405 - 1980). The bagasse pulp webs were sandwiched between the same size laps of cotton knitwear waste of 0.5 g each to improve their stability. The prepared webs were sealed between the top and bottom sheets and sterilization of the napkins was done at high temperatures in an autoclave.

Sanitary napkin prototypes were prepared in regular sizes, in designs of beltless type.

On the basis of the need assessment survey, variations in the design of the knitwear waste prototypes were incorporated to suit the requirements of the women. The developed napkins were evaluated for acceptability over three menstrual cycles in terms of functional utility, ease of use, comfort, absorbency and acceptability of design, as well as, for ease of disposability and clarity of instructions given on the packet. The low cost sanitary napkins were found to be acceptable in performance, aesthetics and cost. The cost of the developed sanitary napkins was less than a rupee and, their quality in terms of physical and hygiene parameters were found to be comparable to branded napkins.

Purpose :

Ensure production of standardized, quality assured, hygienic sanitary napkins by rural adolescents and women for MHM, for improved health and quality of life of adolescent girls and women and promotion of bio-degradable SN other than wood pulp.

Significance of the study :

The reproductive health status of a woman is greatly affected by the quality of sanitary protection and the standard of hygiene maintained during menstruation. In the lower economic strata women often practice the use of old cloth rags as menstrual materials which are washed and reused several times. These women often suffer from itching genitals or abnormal discharge, which is linked to the use of damp rags and inadequate bathing due to lack of privacy. The used menstrual materials are washed in secret and dried in a concealed place inside the house due to which they often remain damp at the time of reuse (WHO, 2002).

Usage of Sanitary Napkin is extremely low in developing nations, resulting in severe societal and health concerns like life threatening diseases, social isolation and high levels of school drop-outs amongst adolescent girls. Surveys reveal that usage of sanitary pads in India is around 12% (mostly in the urban area). In rural areas this figure is as low as 2-3%. The situation is similar/worse in other developing nations of South-East Asia and Africa.

The kind of sanitary protection a women practices depends upon her economic status,

cultural and social taboos as well as awareness levels about the feminine hygiene products. Due to the unavailability of appropriate and ample menstrual aids, coupled with attitudinal and social inhibitions, women perceive menstruation as an illness. This has led to alarming manifestations to the extent that pregnancy is many times seen as a way to escape from this misery.

The efforts to address menstrual management in school sanitation have been poor, where the onset of menstruation is one of the factors contributing to girls' absenteeism and dropout. Of the 113 million children currently not enrolled in schools worldwide, 60% are girls. There is conclusive evidence that girls' attendance in schools is increased through improved sanitation.

In India, research and development efforts in the area of menstrual hygiene management have been limited to commercial ventures that are unable to market products that are affordable by the poor. Women's menstrual hygiene needs have been gravely overlooked in development programs and training modules for health and sanitary workers. There is a glaring need to highlight the issue of what women and adolescent girls require for their menstrual needs in terms of materials, education and facilities for management and disposal.

Though many types of sanitary napkins are available in the local markets, their high cost profile and availability suits only the urban, high end of the consumer section. Less than 7% of the women of lower income group and those residing in the rural areas use readymade disposable sanitary napkins. To encourage the poor women to use sanitary napkins it is important to make them easily affordable and accessible for them.

It has been seen that availability of ample and affordable menstrual materials leads to not only better hygienic practices by women and adolescents, but also to a radical change in their concepts of dignity, relationships and aspirations.

The purpose of this project is to ensure production of standardised, quality assured, hygienic sanitary napkins by rural adolescents and women for MHM, for improved health and quality of life of adolescent girls and women and promotion of bio-degradable SN other than wood pulp.

Requirements :

- Covered space of 20 x 20' with a tiled or chips finished floor, well ventilated
- Stock room of approx. 5 -10 ft. for stocking and sorting of raw material
- Washing area facility
- Electrical connection to run 2-3 machines of 1.5 – 3 hp motor
- Garneting machine
- Washing, hydro extraction and drying machines
- Lap forming machine
- Heat sealing machine
- 100% Cotton knitwear waste
- Polypropylene and Polyethylene sheet
- Silicon release paper
- Chemicals: Rewetting agent - Sandopan OTI liquid, detergent, Caustic soda, chemicals for solubility tests of fibers and Silicon oil.

- Scissors, disposable masks, head gear.
- Chemicals such as Rewetting agent-Sandopan OTI liquid, detergent, Caustic soda, chemicals for solubility tests of fibers and Silicon oil were used.

Market potential :

The low cost sanitary napkin of quality comparable to that of branded napkins can be developed using cotton knitwear waste as the absorbent web. This will make sanitary napkins affordable for women of the lower economic strata thereby improving their health status by ensuring better menstrual hygiene management.

Department of Science and Technology (DST), Government of India, has not only recognized this technology of low cost sanitary napkins but is also supporting 10 recognized institutions to establish commercial units to disseminate these products in different parts of India.

The Researcher along with the DST has conducted several national-level workshops to transfer this technology for manufacturing low cost sanitary napkins with the involvement of Self Help Groups (SHGs). 15 Core group NGOs selected from all over India were invited to participate in these workshops to get trained on the technology developed for manufacturing disposable sanitary napkins from cotton knitwear waste. The trainers and inspectors from these organizations have further trained SHGs of women in their locations/villages. This has thus created facilities by which the low-income rural and semi-urban population of India shall be benefited and would provide a good income source to the women involved in manufacturing and marketing.

Target customer :

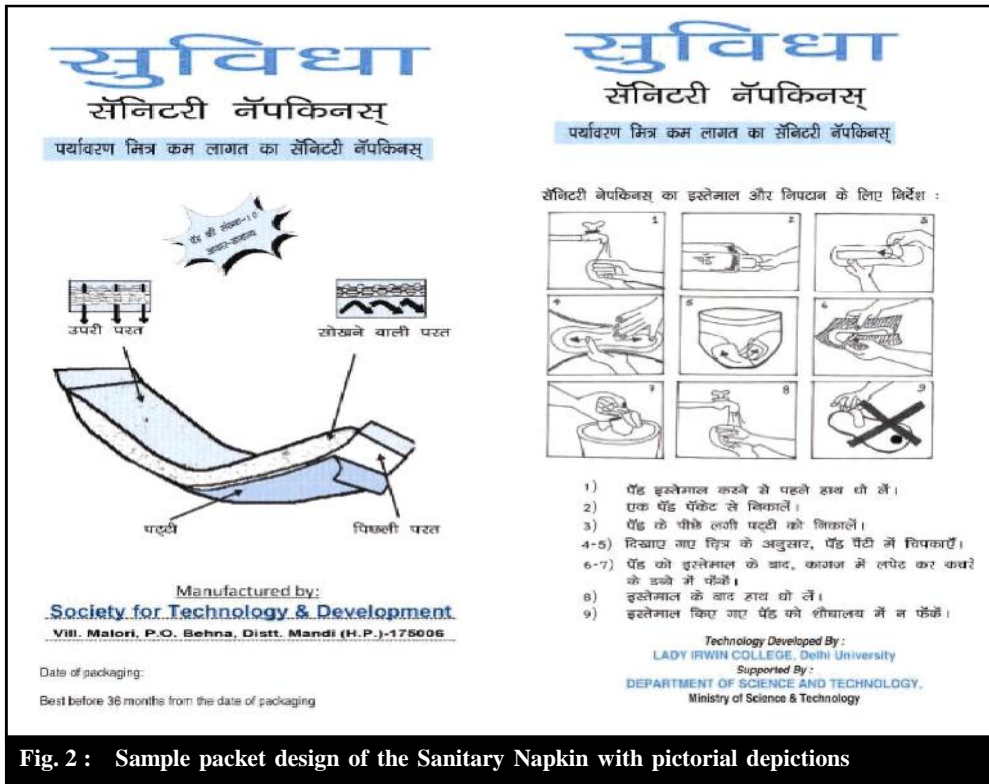
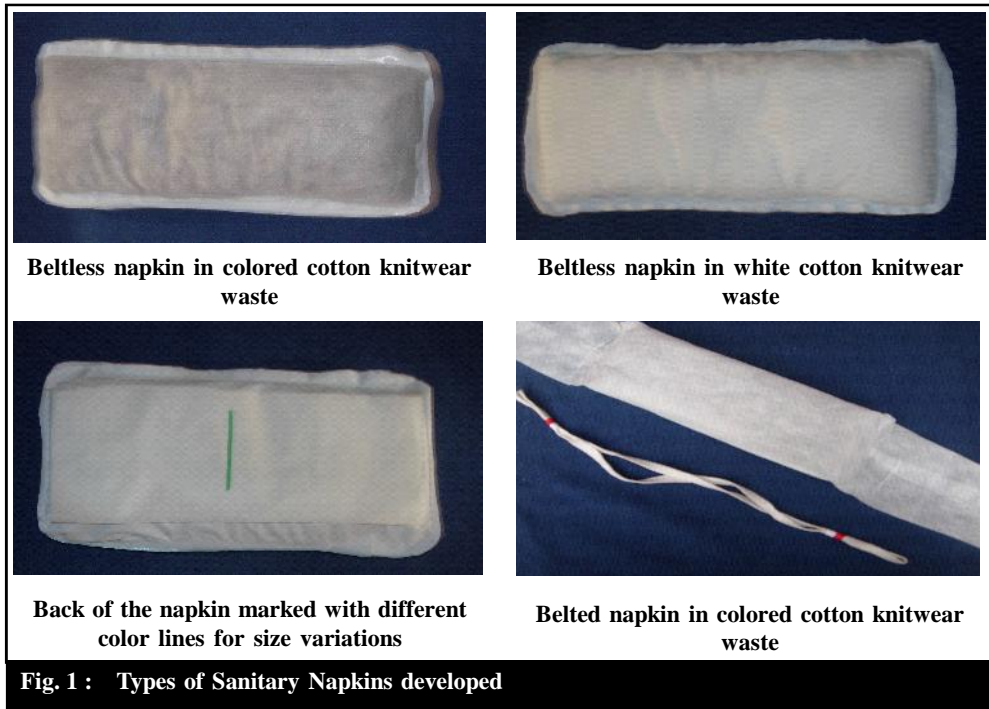
The target consumers are rural population comprising of the poor and middle income families and customers from the urban slums and settlements. The age group varies from 13-45 consisting of:

- First time users (Age 13-17)
- Young adults and young mothers (Age 18-30): shifting from traditional methods to sanitary pads
- Matured/middle- aged women: Change of Habit- age 30-45

Costs benefit analysis :

Benefits of developing such raw materials and napkins: (i) 88% women(AC Nielson data) don't use Sanitary Napkins in India, one of the major reason is un-affordability; this would be a ray of hope for them, (ii) using indigenous resources will lead to more employability in villages and (iii) moreover this solution will directly effect in improved women hygiene and menstrual health in villages which will lead to less disease/death due to unhygienic condition in villages, no work loss/school drop-outs during menstrual period of women/girls, less social problems for women in villages during menstruation period.

On an average, comparison of branded and developed prototype revealed that the cost profile of the branded napkins ranged from Rs.2.50 to 8.50 / napkin. The Ultra-thin varieties were priced at almost 2-3 times more than the Regular types. The prototype prepared using



knitwear waste fiber costs less than the cheapest variety available in the market and the cost involved in the limited trial production has come out to be less than Rs.1/- per pad.

Conclusion :

From the results of the present study, it may be concluded that low cost sanitary napkins of comparable quality as that of branded napkins can be developed using cotton knitwear waste and bleached bagasse pulp as the absorbent web. This will make sanitary napkins affordable for women of the lower economic strata, thus help improve their status of menstrual hygiene management.

Thus, recycling fabrication waste of cotton knitwear and bagasse offers a good option for the development of sanitary napkins at a cost much lower than the prevalent cost of branded products. Currently, the principal raw material used for manufacturing the absorbent layer of these products is wood pulp. At a time of dwindling forest resources, cotton knitwear waste and pulp of bagasse can easily substitute hydrophilic cellulosic staple fibers as eco-friendly, biodegradable and low cost sources of raw materials. Both these materials can be suitably converted to fiber form and processed into compacted webs for developing the absorbent layer of the adult diapers and diaper sheets. Quality of the developed products is comparable to branded products in terms of absorbency, water retention, pH, flexibility, disposability and hygiene parameters. The low cost disposable adult diapers and diaper sheets thus developed will enable the men and women from the lower economic strata to utilize them.

The other brands use Pulp which is made of Pine Wood mostly imported and expensive. We aim to use local agricultural wastes, knitwear wastes and other wastes like Water hyacinth to make the pads, thus:

- Reducing costs
- Creating more localized demand for waste biomass
- Reducing dependency on import markets and international currency fluctuation
- Create livelihood opportunities around raw material procurement/ supply

In an effort to improve the menstrual hygiene status of women of the lower income strata and to make affordable disposable sanitary napkins accessible to women residing in peri-urban and rural villages, the study has been funded by the Department of Science and Technology and declared as a successful technology for manufacture of low cost good quality sanitary napkins. In the next phase workshops were conducted and based on costing; the technology of manufacturing low cost sanitary napkins has been transferred to women belonging to the lower income categories. This has thus created facilities by which the low-income semi urban, rural population of India shall be benefited and can generate a good income source. Social marketing and door-to-door selling has been extended for the distribution of affordable, user-friendly sanitary products for menstrual management.

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