



REMOVAL OF SINGLE USE PLASTIC (SUP) IN SANITARY NAPKIN

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Abstract: Worldwide Production of plastics is more than 300 million tons each year and half of which is for Single Use Plastic (SUP) items. SUP items are generated from non-renewable resources takes a lot of time to decay naturally. Such plastic is also used in sanitary pad napkin on large scale. Most of these sanitary napkins have over approximate 60-70 per cent plastic and each pad is equivalent to four plastic bags. The discarding process of such plastic pads has become a huge concern. Although, some biodegradable sanitary pad brands are available in market, they are quite expensive and not easily available. In the present research paper focus has been given on the issue of non-biodegradability of commercial sanitary pads and proposed a study to develop a method for plastic free compostable sanitary napkin which will evaluate as affordable eco-friendly sanitary napkin and an alternative of plastic free sanitary napkins. The product prepared was analysed for the basic parameters of conformity as per the standard IS: 5405-1980 and was found satisfactory with respect to all studied parameters. This research would lead to future development of an affordable good quality compostable pad contributing no SUP load in the environment.

Keywords: Sanitary napkin; SUP; Environment friendly; Sustainable material; Compostable

I. INTRODUCTION

Sanitary napkins play an important role in the women's hygiene and overall health. They are available in different shapes and sizes with same effectiveness. Now a day's Single-Use Plastic (SUP) emerging as one of the biggest pollutants in the world which is also used in many personal hygiene products like commercial disposable pads for menstruating women. Normally, Single use sanitary napkin contains PET, fluff pulp, PE, PP, adhesives and superabsorbent etc. As per study it is estimated that on an average 335 million menstruating women dispose 432 million pads every month and each single commercially available non-organic sanitary pad is equivalent to about three to four plastic bags (Sareen S., 2021).

The top sheet of sanitary napkin is consists of thermoplastic fibre and hydrophilic absorbent fibre, the absorbent core is made up of SAP (Super Absorbent Polymer) and polyethylene and polymeric film used as barrier sheet are non-breakable by bacteria and is unfavourable for the environment (Chanana B., 2016, Choudhary J. & Bhattacharjee M., 2018).

Each piece of sanitary pad contains approx. 2 gram of non-biodegradable plastic which takes about 500-700 years to decompose or may even never decompose at all (Barman et al., 2017 & Dwivedi A., 2020). Further, on an average a woman could use up to 9000 to 10,000 sanitary pads from menarche to menopause

(Sameena, 2018) that adds to an awful lot of single Use Plastic waste littering our environment and are non-biodegradable (Pohlmann, M. 2016).

Also, disposal of napkins after use is another major concern. As per SWM Rules, 2016, sanitary pads are to be collected separately and shall be incinerated in biomedical waste incinerator, but due to lack of awareness among people and waste pickers approximate 12.3 billion or 113,000 tonnes of used sanitary pads are dumped in landfills in India every year, adding to the already existing plastic pollution in the country (Harrison & Tyson, 2022 & Park et al., 2019). Blockage of sewage system is a global problem and major contributing factor is flushing of menstrual products in toilets (Kara, 2021). It is estimated that municipal bodies are able to collect only about 60 to 70 % of the approximately of waste daily generated in India (Garikipati & Boudot, 2017). Further, data on menstrual waste management from Ministry of Drinking Water & Sanitation (MDWS) shows that 28% of such pads are thrown in open contributes to SUP load of the environment (Nyoni et al., 2011). Most SUP containing pads do not decompose, rather they breakdown into small pieces of plastic referred to as micro plastics and contaminate water, soil and air and also enters into the food chain in some form (Peberdy et al., 2019).

There is very restricted understanding among women about the harmful impacts of using non-decomposable plastic containing sanitary pads on their health and environment equally in rural and urban regions (Dhinakaran et al., 2017 & Sundani et al., 2019). Moreover, discussing period products still carries a stigma especially among teenagers and in mixed gender classrooms. Brands are available in the market that claims for production of completely eco-friendly biodegradable sanitary pads are very limited in numbers and are too expensive to be affordable by low income groups and rural population (Foster J. & Montgomery, 2021). Also, the awareness about the availability of these quality products was found uncommon among women. Therefore, there is a need to develop modest and eco-friendly sanitary napkin without single use plastic.

In the present study an attempt has been made to make sanitary pads more eco-friendly by substituting the SUP layers by compostable material to make it environmentally sustainable which can easily be disposed of in natural soil. Moreover, it reduces the chances of infection and skin irritation and they will be cost effective plastic free sanitary napkins as well at par in the quality & hygiene with other commercial sanitary napkins for improved health and environment. The study may help to encourage manufactures to reduce the composition of all forms of plastic in sanitary pad and develop an alternative approach to remove Single Use Plastic from sanitary napkin and make them available in market for use in affordable range.

II. MATERIALS & METHODOLOGY

A sanitary pad comprises of multilayer structure where each layer has a specific role to play. There are basically three main layers in a conventional pad viz. Distribution layer, Absorbent Layer and Barrier sheet (Mekala M., 2021 & Liu et al., 2014).

The top sheet, also called Distribution layer has its main work to readily absorb the fluid and distributes it throughout the pad. It is generally made up of Air bonded Composite Non-Woven or thermally bonded Non-Woven. The absorbent layer interposed between top sheet & barrier sheet has function to absorb and retain the fluid. The barrier sheet is fluid impervious layer that seals fluid from staining and leakages.

In a commercial available sanitary pad, the top sheet is made up of polypropylene fibre, absorbent core includes synthetic SAP (Super Absorbent Polymer) and Barrier sheet (Fig. 1) consist of Polyethylene breathable film which all contains single use plastic materials (Anuradha et al., 2017 & Mogha et al., 2017.)

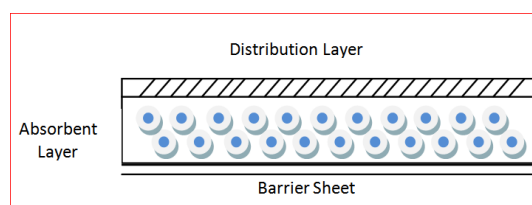


Fig.1

To make the product sustainable with hygiene the plastic components have been replaced with natural components making it more eco-friendly. The polypropylene top sheet is entirely replaced with a compostable starch sheet which is soft, non-irritable, skin friendly and easily wicks away the moisture.

Absorbent core is the primary part of a sanitary pad which must have good absorbency and retention property. The synthetic SAP containing absorbent layer of the pad was replaced with cellulose based hydro gel. It has micro-porous structure that absorbs the fluid very well and is biodegradable in nature.

The widely used material for barrier sheet is non-woven polythene which is a non-biodegradable plastic causing harm to environment. In the developed sanitary pad, this barrier sheet has been replaced by a compostable Poly Lactic Acid sheet prepared from corn starch which is a bio-based sheet and is completely compostable.

The method and technology used to prepare the modified sanitary pad was the same as used in a conventional pad, required no change in any machine or manufacturing set up. Although, as prepared with natural materials, the overall cost of manufacturing this modified eco-friendly pad was found lesser as compared to commercial SUP material containing pads.

III. RESULT & DISCUSSION

To evaluate the quality of prepared sanitary napkin by replacing the top sheet of SUP material by compostable material, it was tested for all the required parameters viz. pH, size, absorbency, disposability, absorbent filler, covering etc. as per the relevant standard IS: 5405- 1980. The results of the test are tabulated in the Table 1.

The results of the test reveal that the prepared pad has passed the all tested parameters and substituting the plastic layers in the pad with compostable layers has no untoward effect on the quality of the product. As detailed in Table 1, the pH of the product was found within prescribed limit of 6-8.5. The result for absorbency test of the sample proclaims that the product has good ability to withstand pressure even after absorption.

In terms of disposability test, the prepared sanitary napkin result is very positive. The product shall disintegrate in water within 5 minutes without covering or shall easily be compostable under scientific conditions.

Table-1 Parameters Analysed for the Prepared Napkin (as per Std. IS: 5405- 1980)

S. No.	Test Parameters	Test Results	Conformity	Requirement as per IS: 5405-1980 (Extra Large Size)	Test Method
1.	pH Value	7.16	Yes	6.0-8.5	IS:1390-1983
2.	Size (in mm)				
	(a) Length	280.86	Yes	280±20	IS:5405-1980
	(b) Width	70.24	Yes	60 to 75	
3.	Absorbency and ability to withstand pressure after absorption	Passes the test	Yes	Fluid shall not stain through/leaking through at the bottom or sides	IS:5405-1980 (Appendix-A)
4.	Disposability	Passes the test	Yes	Sample shall disintegrate in water within 5 minutes without covering	IS:5405-1980

5.	Absorbent filler	Passes the test	Yes	Free from lumps, oil spot, dirt or foreign material	IS:5405-1980
6.	Covering	Passes the test	Yes	Sample shall good quality cotton or rayon knitted sleeving gauge or non-woven fabrics with sufficient porosity.	IS:5405-1980
7.	Manufacture workmanship and finish	Passes the test	Yes	The sanitary napkins shall have a very soft feel and when worn shall not give any uncomfortable feeling. They shall be free from all sort of foreign matter.	IS:5405-1980

The barrier sheet used in the product which is usually a non-woven polyethylene or polypropylene material has been replaced with a bio-based polymer Poly Lactic Acid (PLA) derived from corn starch which is completely bio-degradable in nature and has low carbon foot print.

The manufacturing cost of sanitary pad with natural compostable material was found even more economical than a commercially available conventional plastic material containing sanitary pad. A simple large sized commercial available pad costs Rs. 8 per piece, while the eco-friendly sanitary pad prepared using natural material costs Rs. 1.50 per piece only.

All the parameter of this sanitary napkin has passed the all test with respect to absorption capacity and disposability etc. and showed good results. Therefore, the quality of the developed products is equivalent to branded products in terms of all required parameters viz. absorbency, pH and disposability. Further, it is also laudable to comment that use of such SUP free eco-friendly sanitary pads will reduce 28 per cent SUP load on the environment by non-degradable pads which are not being channelized to incinerators and are thrown in open.

IV. CONCLUSION

There is a need to increase awareness to protect the environment with the adoption of compostable raw materials in sanitary pads substituting Single Use Plastics (SUP). The study shows that plastic free compostable sanitary napkins are more economical and environment friendly with good biocompatibility as uses only natural products, as compared to commercially available SUP based sanitary pad. Plastic free sanitary pads will be a promising alternative in the future for developing affordable, environment friendly sanitary napkins to improve the health and hygiene status of women and will open arenas for further research to make it accessible for low income group women. This study will also be helpful in increasing awareness about personal hygiene among females which is remains one of the primary factors.

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REFERENCES

- [1] Sabrina S., 2021. Sustainable menstrual alternatives-The journey so far. International Journal of Home Science, 07(3):216-219.
- [2] Bhawana C., 2016. Development of low cost Sanitary Napkins: Breaking MHM taboos of women in India. International Journal of Applied Home Science, 3(9&10):362-371.

- [3] Jyoti C., Bhattacharjee M. 2018. A Study on Consumption Pattern of Sanitary Napkin and Environment Degradation. *International Journal of Creative Research Thoughts (IJCRT)*,6(2):580-587.
- [4] Barman A, Katkar PM and Asagekar SD. 2017. Natural and Sustainable Raw Materials for Sanitary Napkin, *Journal of Textile Science & Engineering*, 7 (3):1-3.
- [5] Dwivedi A. 2020. Menstrual Products: Sustainability and Futurity-An Imperative Study on the cognizance towards Eco-Friendly Sanitary Products and Practices., *Shodh Sanchar Bulletin-An International Bilingual Peer Reviewed Refereed Research Journal*,10 (40):37-42.
- [6] Sameena, 2018. Commercialising Menstrual Cycle: The Political Ecology of Menstrual Hygiene Management. *Journal of Emerging Technologies and Innovative Research (JETIR)*, 5 (12):389-394.
- [7] Pohlmann, M. 2016. Design and Materials Selection: Analysis of Similar Sanitary Pads for Daily Use. *International Journal of Engineering Research and Applications*, 6(11): 74-79.
- [8] Megan E. Harrison & Tyson N. 2022. Menstruation: Environmental impact and need for global health equity. *International Journal of Gynecology & Obstetrics*, 160(2): 378-382.
- [9] Park C. J., Barakat R., Ulanov A, Zhong L., Lin P.C., Chiu K., Zhou S, Perez P., Lee J., Flaws J., & Ko C.M.J. 2019. Sanitary pads and diapers contain higher phthalate contents than those in common commercial plastic products. *Reprod Toxicol*, 84: 114–121.
- [10] Kara S. 2021. A Research Study about the Expectations from Sanitary Napkins, Current Problems and Design of a Functional Sanitary Napkin, Erciyes University. *Journal of Institute of Science and Technology*, 37(1): 74-90.
- [11] Supriya Garikipati S. and Boudot C. 2017. To Pad or Not to Pad: Towards Better Sanitary Care for Women in Indian Slums. *Journal of International Development*, 29: 32–51.
- [12] Nyoni, A. B., Sibanda, P., Nkiwane, L. C. & Gonde, P. 2014. Performance Characteristics of Local and Imported Sanitary Pad. *Zimbabwe Journal of Science and Technology*, 2011(7):1-9.
- [13] Peberdy E, Jones A and Green D. 2019. A Study into Public Awareness of the Environmental Impact of Menstrual Products and Product Choice. *Sustainability*, 11(473): 1-16.
- [14] Dhinakaran M., Senthil C.S., Sathis T. 2017. Development and Characterisation of Sanitary Napkins with Lyocell/Modal as Absorbent Core. *International Research Journal of Engineering and Technology (IRJET)*,04(02): 1003-1004.
- [15] Sundani A., Savalsang N., Karnik P., Bhanushali P, Sharma P. 2019. Sustainable Sanitary Napkin. *Journal of Emerging Technologies and Innovative Research (JETIR)*,6(5):43-49.
- [16] Foster J. and Montgomery P. 2021. A Study of Environmentally Friendly Menstrual Absorbents in the Context of Social Change for Adolescent Girls in Low- and Middle-Income Countries. *International Journal of Environmental Research and Public Health*, 18(9766):2-8.
- [17] Mekala M. 2021. Development of Eco-Friendly Sanitary Napkins using Sansevieria trifasciata Fibres coated with Rosa damascena Extracts. *International Research Journal on advanced science hub*, 03 (02S): 76-82.
- [18] Liu H., Zhang Y. and Yao J. 2014. Preparation and Properties of an Eco-friendly Superabsorbent Based on Flax Yarn Waste for Sanitary Napkin Applications. *Fibers and Polymers*, 15(1): 145-152.

- [19] Anuradha, B. Pooja, M. K. & Asagekar, S. 2017. Development of eco-friendly herbal finished sanitary napkin. *International Journal for Innovative Research in Science & Technology*, 4(1): 183-189.
- [20] Mogha A., Singh A. 2017. Quantification of Menstrual Waste and Development of Appropriate Disposal and Management Strategy. *International Journal of Science and Research (IJSR)*, 6(5): 2147-2150.

