

A Short Review on Menstrual Hygiene and Waste Disposal Management: A Sustainable Approach for Green Environment

M. Mary Jennifer¹, P.Kavitha^{2,3}, R.Menaka³

¹Research Assistant, Department of Chemistry, Dr.N.G.P Arts and Science College, Coimbatore, Tamil Nadu, India

^{2,3}Assistant Professor, Department of Chemistry, Dr.N.G.P Arts and Science College, Coimbatore, Tamil Nadu, India

ABSTRACT:

With more than 355 million menstruation people, women in India continue to face obstacles in attaining appropriate menstrual hygiene management (MHM), which is essential for gender equality. In spite of government and non-governmental organization efforts, MHM programs that distribute plastic products contribute to a major trash problem and affect the environment. The products on the market are extremely harmful to the environment and the environment, particularly because of the large amount of plastic that is used in disposable things. In order to address this rising problem, sustainable menstrual products and menstrual waste incinerators in schools and colleges have been proposed. This research aims to determine whether people recognize this issue and whether those who are more aware of the damage are more likely to make environmentally friendly choices. This study particularly focusses on the degree of awareness among the women population of the selected areas in the Coimbatore district on the effects of menstrual product disposal on the environment. The findings of the research indicates that the majority of the participants are unaware of the impact of plastic in menstrual products and the associated environmental problems due to their disposal. Some participants were conscious to select environmentally safe products. The research also recommends the future initiatives in the research area with the conclusion of the findings.

Keywords: menstrual products, plastics, waste disposal, environmental impact.

INTRODUCTION:

Menstruation is a natural process that takes place every month in females. It usually begins in women between the age of 9 – 16 years and stops around 45-55 years. Everyone should take care of their health both physically and mentally and it is essential for women and girls to care for their health especially during menstruation.

The availability of menstrual hygiene products in market is also extensive nowadays. Menstrual hygiene products help women to tackle the issues faced during menstruation and help them do their day to day activities without any problems. Some of the menstrual products are biodegradable, eco-friendly and sustainable in nature which does no harm for the Mother Nature. While most of the commercial synthetic pads are products made up of plastics. These plastics take approximately up to 500 years to degrade in

soil. Commercial synthetic pads contain toxic chemicals in the form of absorbent, which is harmful for both Human health and the Earth.

In this review paper menstrual hygiene and management and environmental impacts are discussed. This emphasis on creating a public awareness about the environmental impacts caused due to improper disposal of menstrual waste products and also encourages women to shift to products that causes no or less harm to the environment.

1. MENSTRUAL HEALTH:

The period between menarche and menopause is called reproduction period. In a women's life time, the collective period of menstrual cycles is represented as the lifetime number of years of menstruation (LNYM). Gavriluk et al., defined, *"the number of years between age at menarche and age at menopause, minus the cumulative duration of full-term pregnancies as the lifetime number of years of menstruation"* [1]. A data found in the article on United Nations International Children's Emergency Fund, Water and Sanitation facilities (WASH) states that every month around 1.8 billion people menstruate worldwide, that is 26% of the world's population [2]. Poor menstrual health leads to many serious health risks such as reproductive and urinary tract infections. Paying close attention to menstrual health is really essential. According to World Health Organization menstrual health refers to, *"a state of complete physical, mental, and social well being and not merely the absence of disease or infirmity, in relation to the menstrual cycle"* [3]. During menstruation following poor hygienic methods increases the chance of getting infections, thrush and rashes, therefore maintaining good menstrual hygiene is essential. Menstrual health solely depends upon practicing good hygiene during menstruation.

2. MENSTRUAL HYGIENE AND MANAGEMENT:

It is crucially important to follow good hygienic practices. Practicing good menstrual hygiene helps preventing the Reproductive tract infections (RTI) and Urinary tract infections (UTI). Menstrual hygiene management was defined by the World Health Organization and UNICEF Joint Monitoring Program (JMP) for water supply, Sanitation and Hygiene in (2012) as *"Women and adolescent girls using a clean menstrual management material to absorb or collect blood that can be changed in privacy as often as necessary for the duration of the menstruation period, using soap and water for washing the body as required, and having access to facilities to dispose of used menstrual management materials. They understand the basic facts linked to the menstrual cycle and how to manage it with dignity and without discomfort or fear"* [4].

On Menstrual hygiene day an article from India today shared five things to keep in mind for personal menstrual hygiene. These tips help in maintain and manage health and good hygiene during periods. They include changing sanitary napkins for every 4-6 hours, keeping themselves clean by washing the intimate areas properly and not using any soaps or vagina hygiene products, discarding the napkins properly and sticking to any one method of sanitation alone for better menstrual hygiene management [5].

Some of the main components of menstrual hygiene management are access to education on menstruation, menstrual products, water and sanitation facilities and safe disposal of menstrual products.

2.1 Access to education:

There are still many people who menstruate have no idea on what's happening in their body and on how period works. That's why education on periods at an early stage is a must, so that they can understand and manage their periods without any serious issues later. In a cross-sectional study among adolescent girls

(10 - 19 years) residing in a tribal area of Nagpur district, only 45.17% of girls were aware of the menstrual cycle before its onset ^[6]. A study in schools across the UK, for both boys and girls is needed to address menstrual cycle education. It highlights that training should be provided to all the teachers, male and female and also to ensure awareness on the menstrual cycle. Doing so is very important to girls to manage their menstrual cycle and seek help whenever needed ^[7].

In a study by D.S. Deo and C.H. Ghattargi, the awareness regarding menstruation in urban and rural girls before menarche was low. The results concluded that the main source of information for urban girls was their mother and for rural girls, teacher was the common source of information. Hence the need for proper menstrual education is necessary ^[8].

2.2 Access to menstrual products:

There are extensive numbers of period products commercially available but a study on exploring menstrual products by Van Ejik et al., states that reusable menstrual pads may be an effective alternative ^[9]. According to Das P. et al., unhygienic menstrual hygiene practices lead to urogenital infections. The Menstrual hygiene management is also highly affected by associated factors such as access to facilities like having places to wash menstruation clothes with privacy and comfort and access to menstrual products ^[10].

2.3 Access to water and sanitation:

Schmitt et al., disclosed that there is a lack of access to key aspects like menstrual products and sanitation facilities for the maintenance of menstrual hygiene. Water and Sanitation play an important role in providing an adequate environment for women in Menstrual Hygiene Management ^[11]. In another study, the need for maintenance of reusable and disposable menstrual materials, improvement in innovation and operation of female-friendly WASH facilities, and continuous consultation and monitoring with girls and women should be done to meet their needs extensively ^[12]. A cross sectional survey conducted in rural and urban field areas in Perambalur district revealed that the rural population has 99.1 percent more improved source than the urban. It also added that 25.2% of households lacked a toilet and 72.7% used the flush/pour flush technique. Here hygiene practices are found to be associated with the socioeconomic status of the population and also the place of residence in terms of sanitation ^[13].

2.4 Access to safe waste disposal:

Menstrual waste contributes to one of the most important reasons for poor waste management. Since most of the products contain plastics and harmful absorbents that have an adverse effect on the environment they must be disposed of in a proper way. In both rural and urban schools in Bangladesh, the chute disposal system was found to be sustainable and easy to use and maintain ^[14]. A study by Deshpande T.N. et al., revealed that menstrual hygiene was unsatisfactory among adolescent girls from an urban slum area of Karad. This was because of the low level of education provided, the wrong perception regarding menstruation, and largely because most of the girls from the slum were school dropouts. Some girls even had no information on proper disposal of the used menstrual product. This study highlighted on providing awareness to teachers, parents and even men in general contribute in helping women during menstruation ^[15].

3. MENSTRUAL HYGIENE PRODUCTS

Menstrual hygiene products/materials are “those used to catch menstrual flow such as cloths, reusable and disposable pads, menstrual cups and tampons” ^[16]. There is wide range of menstrual products

available in the market commercially. List of menstrual hygiene products and their specific uses are given underneath in detailed.

3.1 MENSTRUAL CUP:

A Menstrual cup is made up of non-allergic, non-toxic silicone material, which is used to collect the menstrual fluids. It is reusable and can be used for up to 10 years if it is maintained well and in good condition. Menstrual cups are safe to use, durable, and eco-friendly. A cross-sectional study conducted in A.J. Institute of Medical Science Hospitals, Mangalore collected statistical data on the awareness regarding menstrual cups and came to know that the knowledge, attitude, and acceptance of menstrual cups among educated groups were appreciated. Since menstrual cups are cost-effective, reusable, require less water to clean, and are easy to maintain hygiene, it also emphasizes creating awareness on increasing the use of menstrual cups among rural women of India ^[17].

3.2 TAMPON:

It is a menstrual product designed to absorb menstrual blood and vaginal secretions by inserting it into the vagina during menstruation. Tampon once held in place inside the vagina, expands by soaking up the menstrual blood. Many traditional beliefs and concerns about toxic shock syndrome and other health problems lead to less purchasing of tampons. Tampons used as a menstrual product may be the source of chemical exposure that could be associated with adverse health ^[18].

3.3 DISPOSABLE PAD:

Disposable pads or sanitary napkins are used to absorb menstrual blood flow. Disposable pads are the most commonly used menstrual products. It is because of their availability, affordability, and most importantly high absorption rate due to the absorbent layer present inside. Ram Usha et al., taking into account the national representative data in their study examined the use of disposable absorbents during menstruation, based on caste, exposure to mass media, demographic, and other socio economic factors among young women in India. Even though menstrual products are a personal choice of an individual most of the South Indian women use reusable products which may have any adverse health effects if not followed with good hygienic practices. The finding of the study helps to promote the usage of disposables aiming to improve reproductive health and suggests overcoming the discrimination among castes through providing educational outreach programs. It also highlights the importance of mass media for better knowledge of disposables ^[19].

3.4 REUSABLE PAD:

Reusable pads are manufactured from soft absorbent fabrics, such as hemp and cotton. They are designed in a way that they can be washed, dried and reused multiple times. It is an eco-friendly alternative that reduces the environmental impact of menstrual waste. A study by Hennegan et al., supported the effectiveness and acceptability of providing reusable cloth pads. This study mainly emphasized that beyond increasing access to sanitary products, providing water, sanitation, and hygiene (WASH) facilities in schools is much more important. It also implies on new consideration for research and improving proper functioning of menstrual health and hygiene ^[20].

3.5 CLOTH:

Cloth is used to collect the menstrual blood during menstruation. According to the latest National Family Health Survey (NFHS) report about 50 percent of women aged 15 – 24 years still use cloth for menstrual protection. It is said that if the unclean cloth is reused, it increases exposure to multiple infections. The used cloth should be washed thoroughly and dried well in sunlight and then it can be reused. In an exploratory qualitative study in Malawi, designed by Kambala et al., in-depth interviews and focus group

discussions with women and girls were conducted to understand the acceptability of menstrual products. Some women preferred the traditional cloth pieces, particularly from old blankets, they reported that they had better soaking abilities compared to the disposable ones ^[21].

4. MENSTRUAL WASTES AND DISPOSAL:

Menstrual wastes are products or other substances which have been used to soak up, hold or collect menstrual blood during menstruation. The solid waste management rules,(2016) has defined them as sanitary waste which means *wastes comprising of used diapers, sanitary towels or napkins, tampons, condoms, incontinence sheets and any other similar waste* ^[23]. Used Menstrual products should be disposed in a way that contributes to sustainable waste management. Disposal methods for each product vary due to the fact that some products are of one time use disposables and others are reusable. The below given figure represent how to dispose the used menstrual products in an effective manner and also how to reuse the sustainable products.

5. WASTE MANAGEMENT:

In the world we live in today, waste generation is doubling due to the increasing population, rapid urbanization, and Industrialization. In order to promote proper hygiene and sanitation waste management is necessary. It is classified into four major types of waste such as municipal solid waste, industrial waste, agricultural waste, and hazardous waste. Waste management mainly concentrates on the disposal and recycling of waste. There are about 4 most common types of waste management. They are Landfills, Recycling, Incineration and Composting. Wastes are recycled, or disposed of in landfills, incinerated, and sometimes even composted.

Waste management is rising as a serious issue these days. The public has awareness of waste management to some extent. But they are still hesitant about it. Both urban and rural areas have poor waste management techniques. Help from both the Public and a private sector is needed. The survey done in Madurai, Tamilnadu by Bala Subramanian and Thulasi Brindha clearly explains the dire need for proper waste management ^[23].

The Central Pollution Control Board (CPCB) Ministry of Environment and Forest has taken an approach towards the implementation of Municipal Solid Waste (MSW) in Management and Handling Rules, 2000. In Annexure-1, the action points for management of MSW in accordance with rules are included ^[24].

A geographical analysis of Solid waste management in selected Indian cities was conducted. In this analysis, bio-methanation and composting are considered to be the most suitable disposable methods in wastes containing high content of organic matter and moisture content. Thus waste materials can be reduced and reused and even some useful products can be restored. Refuse-derived fuel (RDF) and incineration processing plants were established in some cities if the moisture content and biodegradable wastes are removed ^[25].

The municipal solid waste conducted by Central Pollution Control Board (CPCB) through assistance of EPTRI (1999-2000), NEERI-Nagpur (2004-2005) CIPET(2010-2011) has conducted survey of solid waste management in 59 cities, (35 metro cities and 24 state Capitals) ^[26].

5.1 WASTE MANAGEMENT AND SUSTAINABLE DEVELOPMENT GOALS

Proper waste management contributes to the achievement of Sustainable Development Goals (SDG). In a research conducted by S. Gupta et al., it is stated, in India the weakest link in the chain of waste management is collection of waste. Provisions of waste bins at proper distance, separation of wastes into

bio-degradable and non-biodegradable and attitude of the public on waste management should be considered. For overall improvement of waste management privatization is recommended, if private sectors shares some of the corporation works then corporation could concentrate more on other resources [27].

Integrated solid waste management refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency [28]. This paper takes into consideration the integrated solid waste management (ISWM) without any distinction of sectors to develop new pathway for future research. It is concluded that ISWM is affected by the environment and it depends on the treatment, recycling and disposal of wastes [29].

5.2 MENSTRUATION AND SUSTAINABLE DEVELOPMENT GOALS:

Menstrual waste management and sustainable development goals (SDG's) go hand in hand. There are about seventeen SDG's which is the most important part of the 2030 agenda for sustainable development goals. The correlation between menstruation and some of the important Sustainable Development Goals (SDG) are discussed.

5.2.1 Goal 3: Good health and well-being

Goal 3 - "Ensure healthy lives and promote well-being for all at all ages" SDG - 3 contains nine targets under which reproductive and environmental health is specified under targets 3.7 and 3.9 respectively. Sexual and reproductive health ensures that by 2030 there should be universal access to information and education, reproductive health care services which includes family planning, and integration of reproductive health into national programmes. Target 3.9 concerning environmental health states that by 2030 illness from hazardous chemicals through pollution of air, water, and soil contamination. Maintaining the menstrual health of women and girls is important similarly preventing the environment from pollution is also crucial in order to promote well-being for all.

5.2.2 Goal 4: Quality education

Goal 4 - "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" SDG - 4 highlights on equal quality education for all. It contains 10 targets in which target 4.7 and 4.8 are of main concern. The former target insists that by 2030 all the learners should gain skills and knowledge regarding sustainable development and later gives importance in building safe and upgraded facilities that are child, disability and gender specific. Thus quality education and facilities for women and girls should be provided so that they can learn about menstruation and hygiene management beforehand and gain from it.

5.2.3 Goal 5: Gender Equality

Goal 5 - "Achieve gender equality and empower all women and girls" target 5.5 makes sure that by 2030 women will effectively participate and have equal opportunities for leadership in all political, economic and public life. Women's participation should not be affected by any means especially by menstruation.

5.2.4 Goal 6: Clean water and sanitation

Goal 6 - "Ensure availability and sustainable management of water and sanitation for all" target 6.2 plans to achieve equal and adequate access to sanitation and hygiene for all and it also pays special attention to women and girls in vulnerable situations. Having access to clean water and sanitation during menstruation is really essential for women and girls.

5.2.5 Goal 12: Responsible consumption and production

Goal 12 – “Ensure sustainable consumption and production patterns”. Target 12.4 makes sure that effective management of waste by 2020 is achieved in order to reduce the negative impact on human health and the environment. Target 12.5 insists on reducing the waste generation through prevention, reduction, recycling, and reuse by 2030. Therefore, consuming sustainable products that are environmental friendly and disposal of menstrual wastes properly is very much needed.

5.2.6 Goal 14: Life below water

Goal 14 – “Conserve and sustainably use the oceans, seas and marine resources for sustainable development”. Target 14.1 mainly discusses regarding marine pollution of all kinds. This includes marine debris which mainly consists of plastics, nutrient pollution and also particularly pollution from land-based activities. Target 14.3 addresses the impact of ocean acidification and enhanced scientific cooperation to minimize it. Main factors of acidification are increase in Carbon-di-oxide in water which may be due to the increased carbon-di-oxide produced from burning fossil fuels, improper waste disposal and land management. Both targets insist on saving marine life below water, burning sanitary pads, dumping of menstrual wastes into lands and ocean are also one of the main contributing factors for the destruction of life below water. Proper waste disposal and management techniques should be followed to prevent this from happening ^[30] (Fig.4).

6. CULTURAL AND RELIGIOUS BELIEFS

Menstruation is considered a societal taboo until now. It is believed to be unclean or impure. There exist various cultural aspects and views regarding the menstrual blood. It is based on the customs followed by the community and religion.

There were misconceptions, misbelieves and myths regarding menstruation prevailing among illiterates and literates. Menstruation blood is considered dirty and some of the practices which are followed regularly have been prohibited ^[31].

Cohen describes how menstruation and religion are interconnected through the cultural and religious belief systems. Women are still restricted to some practices during menstruation and they should purify themselves through some ritual practices since menstrual blood is considered impure. In this paper it is discussed in detailed regarding various religious beliefs existing from the earlier days till now ^[32].

7. EMPIRICAL STUDIES ON WASTE DISPOSAL AND ENVIRONMENTAL IMPACT

There already exists some works related to the menstrual wastes disposal and environmental impact caused due to the menstrual wastes. Some of them are discussed below.

This is a cross-sectional, community-based study conducted by Balamurugan et al., for a period of 3months among 200 women of reproductive age group (15-45 years) in a rural field practice area. In order to follow better menstrual hygiene practices, awareness should be created through Educational television programs, trained school nurses/health personnel, motivated school teachers, and knowledgeable parents thus promoting positive attitudes towards management of menstruation and related problems among the adolescent girls^[33].

A study conducted by National Faecal Sludge and Septage Management (FSSM) menstrual waste disposal legal framework and the common practices followed for menstrual wastes, alternative products and their disposal and usage of incinerators. Using decentralized incinerators as the disposal mechanisms for

menstrual waste is encouraged and the quality of the incinerators should be aligned with the required standards ^[34].

Singh et al., in a cross-sectional study was conducted among adolescent women in rural India. With substantial geographic disparities at the state and district levels only 42 percent of the rural women used hygiene methods. There exists a wide difference in socioeconomic and bio demographic groups. Key focus relies on adopting context specific interventions for adolescent women in rural India ^[35].

Girls of 10-16 year old were selected from schools and information was collected by interviewing a pre-designed form. The information included school sanitation, information about menstruation and the premenstrual period practices and beliefs about the menstrual cycle and the impact of menstruation on school life. Data were presented as percentages and simple measurements and results were drawn. School girls in Gadag district have good knowledge about menstrual hygiene and waste disposal. Problems related to the menstrual cycle disposal can be effectively dealt with by providing and Improvement of sanitary facilities of water, water and electricity with the joint efforts of the government interventions, school management and appropriate health education of girls and parents ^[36].

Ash Pachauri et al., states that need to understand the sustainability; policy designing and promoting sustainable waste management is crucial and important responsibility of all. This paper focuses on the unregulated wastes generated from the self care products and how they are dealt with. They also discuss regarding the holistic self care waste management through cross-sectoral partnerships ^[37].

G.Bhor and S.Ponkshe in their research identified an issue rising with the disposal of menstrual wastes specifically. Waste pickers are exposed to the soiled diapers, menstrual pads and cloths. They pick them up with their bare hands to separate the wastes which are very harmful for their health. Hence they designed an incinerator which is cheaper and it can be installed at washrooms so that disposal is made easier at the generation point itself and also safe and healthier sanitation is achieved ^[38].

A study on menstrual hygiene management in Periyanaicken-Palayam and Narasimhanaicken-Palayam was conducted through one-on-one interviews and survey. This study revealed various factors related to menstrual hygiene management. Usage of sanitary pads, waste disposal, socio-economic background and also their point of view towards menstruation was observed. The study highlighted the key points to be considered and also concluded that the focused interventions should be mainly followed in the area of disposal ^[39].

Babbar and Garikipati studied the socio-demographic factors among girls and women in India. In this research main debate concerning the factors supporting the choices of women and girls are discussed. This study used the latest national representative data set, NFHS – 5 (2019 - 2021). It is found that after the impact of COVID- 19 the use of disposables increased drastically and improper menstrual waste management leads to the environmental burden. It also discusses the cultural factors, lack of WASH facilities, disposable period products, and awareness of sustainable products among women and girls in India. It emphasizes the government and policy makers to create awareness and focus on improving the usage of reusable period products, so that sustainability and resilience is achieved ^[40].

CONCLUSION:

This study implies on the improvement of menstrual hygiene management and disposal of menstrual wastes in such a way that they does not have any negative impact on the environment. In order to achieve better waste management every individual should take the first step by separating the wastes accordingly at home. Sustainable menstrual products are encouraged compared to the disposable products. Proper

education, sanitation facilities, and menstrual hygiene products should be provided to women and girls to promote menstrual hygiene management.

REFERENCES:

1. Oxana Gavriluk, Tonje Braaten, Elisabete Weiderpass, Ildir Licaj, Eiliv Lund. "Lifetime number of years of menstruation as a risk index for postmenopausal endometrial cancer in the Norwegian Women and Cancer Study", (2018 May 21), <https://doi.org/10.1111/aogs.13381>
2. Menstrual hygiene: Gender inequality, cultural taboos and poverty can cause menstrual health needs to go unmet. Available at: <https://www.unicef.org/wash/menstrual-hygiene> (Accessed January 12, 2023).
3. The WHO statement on menstrual health and rights during the recent 50th session of the Human Rights Council panel discussion on menstrual hygiene management, human rights and gender equality (13 June-8 July 2022). Available at: <https://www.unwater.org>
4. WHO/UNICEF. Consultation on draft long list of goal, target and indicator options for future global monitoring of water, sanitation and hygiene. . WHO/UNICEF. 2012. (cited 2020 Jan). Available at <https://washdata.org/sites/default/files/documents/reports/2017-06/JMP-2012-post2015-consultation.pdf>.
5. Shivani Chhabra, "5 things to keep in mind for your menstrual hygiene", India today, 28 May 2017.
6. Sonali K. Borkar , Avinash Borkar , Mohammed K. Shaikh , Harshal Mendhe , Ranjit Ambad , Abhishek Joshi (Oct 2022) , Study of Menstrual Hygiene Practices Among Adolescent Girls in a Tribal Area of Central India, doi:10.7759/cureus.30
7. Brown N, Williams R, Bruinvels G, Piasecki J and Forrest LJ (2022) Teachers' Perceptions and Experiences of Menstrual Cycle Education and Support in UK Schools. *Front. Glob. Womens Health* 3:827365. doi: 10.3389/fgwh.2022.827365
8. Deo, D.S.; Ghattargi, C.H.. Perceptions and Practices Regarding Menstruation: A Comparative Study in Urban and Rural Adolescent Girls. *Indian Journal of Community Medicine* 30(1):p 33, Jan–Mar 2005.
9. Van Eijk AM, Jayasinghe N, Zulaika G, Mason L, Sivakami M, Unger HW, et al. (2021), Exploring menstrual products: A systematic review and meta-analysis of reusable menstrual pads for public health internationally. *PLoS ONE* 16(9):e0257610. <https://doi.org/10.1371/journal.pone.0257610>
10. Das P, Baker KK, Dutta A, Swain T, Sahoo S, (2015) Menstrual Hygiene Practices, WASH Access and the Risk of Urogenital Infection in Women from Odisha, India. *PLoS ONE* 10(6):e0130777. doi:10.1371/journal.pone.0130777
11. Margaret L. Schmitt, Caitlin Gruera, David Clatworthyb, Christopher Kimonyeb, Deborah E. Peterb and Marni Sommera , (2022) *Journal of Water, Sanitation and Hygiene for Development* Vol 12 No 7, 517 doi:10.2166/washdev.2022.213
12. Schmitt, M.L., Wood, O.R., Clatworthy, D. et al. Innovative strategies for providing menstruation-supportive water, sanitation and hygiene (WASH) facilities: learning from refugee camps in Cox's bazar, Bangladesh. *Confl Health* 15, 10 (2021). <https://doi.org/10.1186/s13031-021-00346-9>
13. Muniyapillai T, Kulothungan K, Vignesh N J, et al. (October 10, 2022) Water, Sanitation, and Hygiene (WASH) Practices Among Households in Perambalur District: A Cross-Sectional Study. *Cureus* 14(10): e30115. DOI 10.7759/cureus.30115

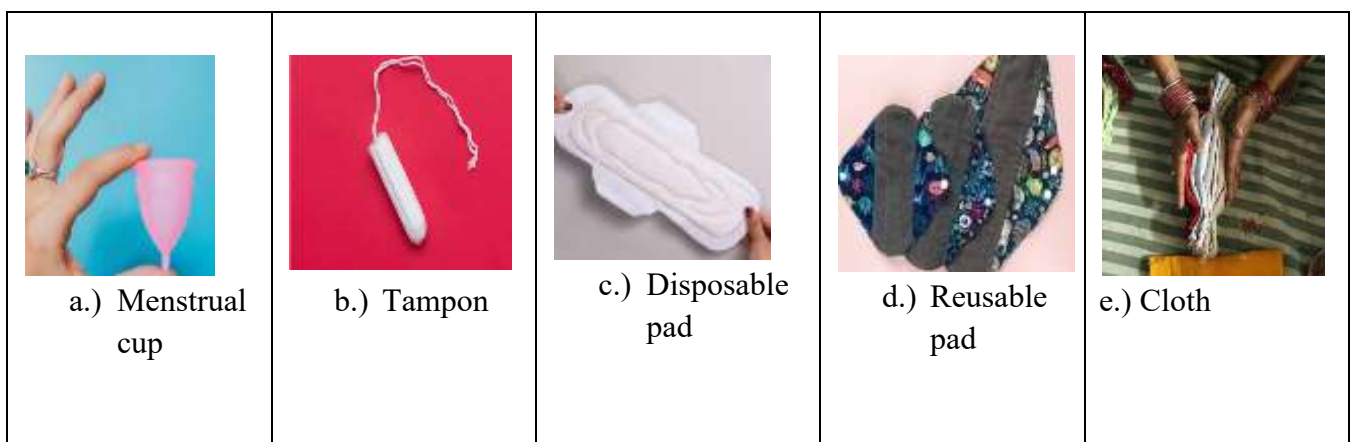
14. Jahan, F., Nuruzzaman, M., Sultana, F. et al. Piloting an acceptable and feasible menstrual hygiene products disposal system in urban and rural schools in Bangladesh. BMC Public Health 20, 1366 (2020). <https://doi.org/10.1186/s12889-020-09413-x>
15. Deshpande TN, Patil SS, Gharai SB, Patil SR, Durgawale PM 2018. Menstrual hygiene among adolescent girls – A study from urban slum area. J Family Med Prim Care 2018;7:1439-45. doi: 10.4103/jfmprc.jfmprc_80_18
16. UNICEF - Guide to Menstrual Hygiene Materials (May 2019) <https://www.unicef.org/media/91346/file/UNICEF-Guide-menstrual-hygiene-materials-2019.pdf>
17. Shwetha Ballal K., Amritha Bhandary, Menstrual cup: awareness among reproductive women, (March 2020), DOI: <http://dx.doi.org/10.18203/2320-1770.ijrcog20201066>
18. Singh, J., Mumford, S.L., Pollack, A.Z. et al. Tampon use, environmental chemicals and oxidative stress in the BioCycle study. Environ Health 18, 11 (2019). <https://doi.org/10.1186/s12940-019-0452-z>
19. Usha Ram, Manas R. Pradhan, Sunita Patel, F. Ram, Factors associated with disposable menstrual absorbent use among young women in India, International Perspectives on Sexual and Reproductive Health, Vol. 46 (2020), pp. 223-234 (12 pages), <https://doi.org/10.1363/46e0320> <https://www.jstor.org/stable/10.1363/46e0320>
20. Julie Hennegan, Catherine Dolan, Laurel Steinfield and Paul Montgomery, Reproductive Health (2017), A qualitative understanding of the effects of reusable sanitary pads and puberty education: implications for future research and practice, doi:10.1186/s12978-017-0339-9
21. Christabel Kambala, Angela Chinangwa, Efe Chipeta, Belen Torondel and Tracy Morse, Reproductive health (2020), Acceptability of menstrual products interventions for menstrual hygiene management among women and girls in Malawi, <https://doi.org/10.1186/s12978-020-01045-z>
22. Source of images from the Internet.
23. Central Pollution Control Board, Solid Waste Management Rules 2016, <https://cpcb.nic.in/rules-2/>
24. M. Balasubramanian and V. Dhulasi Birundha, Applied journal of hygiene, (July 2012), An Economic Analysis of Solid Waste Management in Madurai District, Tamil Nadu, DOI: 10.5829/idosi.ajh.2012.1.1.55156
25. Central Pollution Control Board, Municipal Solid Wastes (Management and Handling) rules 2000, https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2010-11.pdf
26. Tutun Hazra and Arun K. Singh, The Goa Geographer, Vol. XV No. 1, Dec. 2018 ISSN 0976-786X, UGC Index Journal No. 958/ 63041 29, Solid waste management in selected Indian cities: A geographical analysis.
27. Status report on municipal solid waste management, Report of central pollution control board on “status of compliance by CPCB with municipal solid wastes (MANAGEMENT AND HANDLING) RULES, 2000”.
28. Shuchi Gupta, Krishna Mohan, Rajkumar Prasad, Sujata Gupta, Amn Kansal, Resources, conservation and recycling, (May 1998), Solid waste management in India: options and opportunities.
29. Source: United Nations, Mushtaq Ahemd MEMON International Environmental Technology centre, IETC, Osaka - JAPAN, Integrated Solid Waste Management https://sustainabledevelopment.un.org/content/dsd/csd/csd_pdfs/csd-19/learningcentre/presentations/May%20%20am/1%20-%20Memon%20-%20ISWM.pdf

30. Edza Aria Wikurendra, Imre Nagy, (April 2022), Trends in integrated waste management research: A content analysis. doi: <https://doi.org/10.33086/etm.v2i1.2911>
31. United Nations, Sustainable development goals, communication materials, <https://sdgs.un.org/>
32. Rajkumar Patil, Lokesh Agarwal, M Iqbal Khan, Sanjeev Kumar Gupta, Vedapriya DR , M Raghavia, Anuj Mittal, Indian Journal of Medical Specialities 2011, Beliefs about menstruation: a study from rural Pondicherry.
33. Cohen I. Menstruation and Religion: Developing a Critical Menstrual Studies Approach. 2020 Jul 25. In: Bobel C, Winkler IT, Fahs B, et al., editors. The Palgrave Handbook of Critical Menstruation Studies [Internet]. Singapore: Palgrave Macmillan; 2020. Chapter 11. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK565592/> doi: 10.1007/978-981-15-0614-7_11
34. S Sangeetha Balamurugan, SS Shilpa, Sheethal Shaji, Journal of Basic and Clinical Reproductive Sciences · (July - December 2014) · Vol 3 · Issue 2, A Community Based Study on Menstrual Hygiene among Reproductive Age Group Women in a Rural Area, Tamil Nadu, doi: 10.4103/2278-960X.140040
35. Neeti Bhatt, Vanya Gupta, Aparajita Bharti, Menstrual waste disposal in India,(March 2020), A Study by TQH Consulting for the NFSSM Alliance. <https://thequantumhub.com/wp-content/uploads/2020/05/TQH-Report-Menstrual-Waste-Disposal-Incinerators-28th-May-2020-Final.pdf>
36. Aditya Singh , Mahashweta Chakrabarty, Shivani Singh , Rakesh Chandra , Sourav Chowdhury and Anshika Singh,(Nov 2022), Menstrual hygiene practices among adolescent women in rural India: a cross-sectional study, <https://doi.org/10.1186/s12889-022-14622-7>
37. Dharana A, Kale S, Mayappanavar R.A study of knowledge, attitude, practices of menstrual hygiene and its waste disposal management among adolescent schoolgirls of Gadag District of Karnataka, India.Int J Reprod Contracept Obstet Gynecol2019;8:4219-23.
38. Ash Pachauri et al., (April 2019), Safe and sustainable waste management of self care products, doi:<http://dx.doi.org/10.1136/bmj.11298>
39. Gautami Bhor, Sayali Ponkshe, (2018), European Journal of Sustainable Development (2018), 7, 3, 334-344 ISSN: 2239-5938 Doi: 10.14207/ejsd.2018.v7n3p334
40. TNUSSP, 2018. Scoping Study on Menstrual Hygiene Management in Periyanaicken-Palayam and Narasimhanaicken-Palayam
41. Babbar K, Garikipati S (2023) What sociodemographic factors support disposable vs. sustainable menstrual choices?, Evidence from India's National Family Health Survey-5. PLoS ONE 18(8): e0290350. <https://doi.org/10.1371/journal.pone.0290350>

Table-1: This table represents the municipal solid wastes conducted by CPCB through, a)EPTRI (1999-2000), b)NEERI (2004-2005), c)CIPET (2010-2011)

Sl.NO	NAME OF THE CITY	Municipal solid waste(tonnes per day)		
		1999-2000 (EPTRI)	2004-2005 (NEERI)	2010-2011 (CIPET)
1	Bangalore	2000	1669	3700
2	Chennai	3124	3036	4500

3	Coimbatore	350	530	700
4	Delhi	4000	5922	6800
5	Hyderabad	1566	2187	4200
6	Kochi	347	400	150
7	Kolkata	3692	2653	3670
8	Mumbai	5355	5320	6500
9	Pondicherry	-	130	250
10	Visakhapatnam	300	584	334



Source: Images from the internet ^[22].

Figure-1: Illustrates the images of the menstrual products available on the market. a) Menstrual cup, b) Tampon, c) Disposable pads, d) Reusable pads, e) Cloth.

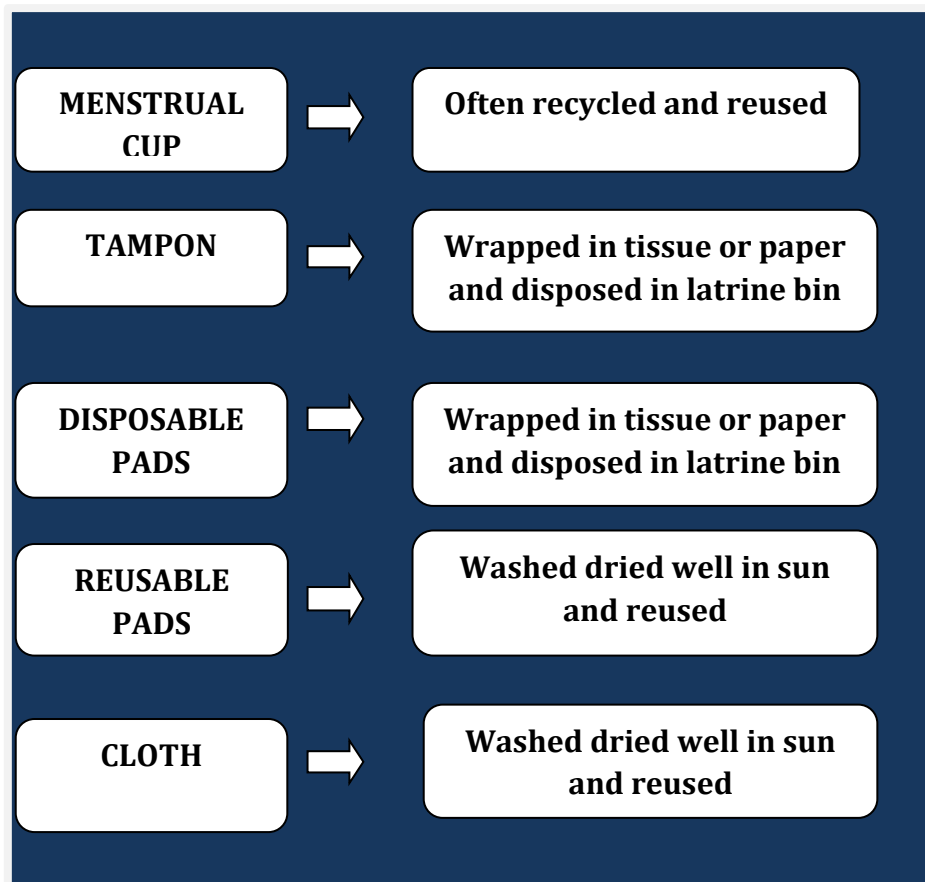
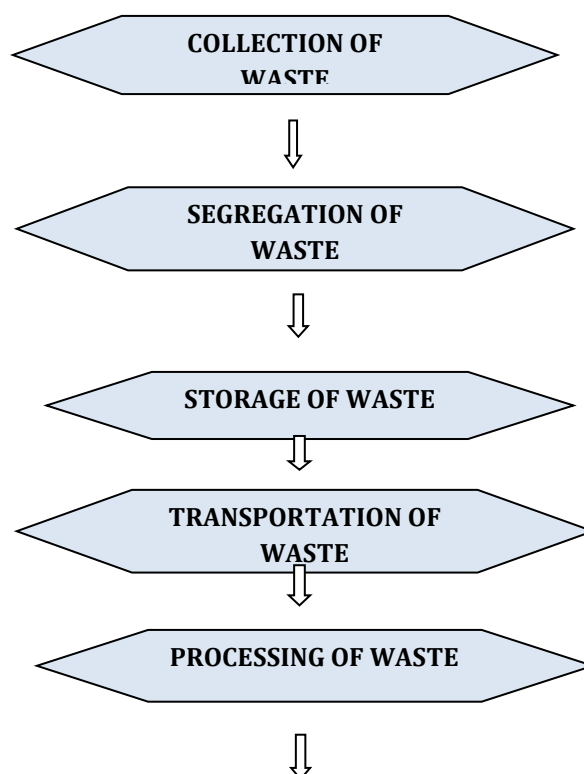


Figure-2: Represents the types of menstrual products used and how they are disposed



DISPOSAL OF WASTE

(Source: An approach towards implementation of MSW, Management and Handling Rules, 2000)^[24]

Figure-3: A flow chart representing the management of Municipal Solid Waste.



Source: United Nations, Sustainable development goals, communication materials ^[30].

Figure-4: Sustainable Goals representing the waste disposal