

THE ERA OF CLOTH NAPPIES AND BABY DIAPERS

Dr. S. Aishwariya¹ and P. Priyanka²

¹Department of Textiles and Clothing,
Avinashilingam Institute for Home Science and
Higher Education for Women, India.

²Department of Costume Design and Fashion,
Hindusthan College of Arts and Science, India.

Abstract

Diapers are the third largest consumer waste in the world which takes five hundred years to decompose. In the UK, they have analyzed that there are quantities of disposable nappy waste compared to household wastes. These are made of plastics that take more than 100 years to decompose completely. Cloth napkin has the advantage of being semi-sustainable with merits like ventilation, comfort, skin-friendly, long-lasting, and economically good. The diapers have engulfed the market of cloth napkins on aesthetics, convenience, no requirement for detergents, electricity, and laundry. Diapers are listed to be equally a threat like the one time use and throw plastic bottles but are discussed less. Today various brands have replaced cotton with bamboo and hemp, along with using the unbleached pulp in the core. The compostable diapers have been a thing of the past where flushable textiles in diapers are exciting for the consumers. This article addresses the nature of cloth napkins and disposable diapers along with the ongoing researches and sustainable solution.

Keywords: sustainable, diaper, decompose, wipes, napkins, recycling, composting, biodegradable, infants, babies, nappies

Introduction

It is estimated that a baby in its nappy wearing life time uses approximately five thousand nappies. Statistics reveal that eight million nappies are thrown away per day in the UK which leads to three billion in a year. Even a well-educated consumer fails to differentiate the pollution over convenience which makes this non-woven industry stay away from sustainability. Textile while ranked second in terms of pollution, has made a multitude of efforts to install new renewable fibers, green chemistry for fabric processing, and sustainable packaging materials. These major areas have overshadowed the problems caused by disposable materials like wipes, napkins, diapers. It is a fact that diapers are equally a threat to the one time use and throw plastic bottles, but less spoken. Unfortunately, the number of disposable materials in the market is increasing every year to match consumer needs.

The industry is currently working towards sustainable production in all forms starting from the sourcing of the raw material to the packaging. The life cycle of the product is under investigation for certification of various green labels that are essential in exporting the goods and widening a company's profit. Certainly, investigations on finding the potentialities of new sources like pineapple leaf, sisal, aloe vera, banana, bamboo, water hyacinth, milk, corn husk, soya bean, and orange peel are explored to find its suitability to be textile material. Besides, the development of disposable textiles like wipes, cleaning materials, sanitary napkins, baby diapers, compostable pads, flushable materials is growing at an unstoppable rate. The harmful nature of disposable diapers is less spoken and the traditional sustainable solution of cloth nappies is getting back on trend. The awareness on consumer on both sides of the coin is explained, which will enable he/she to make the right choices in their life. This article is focused on the objective of increasing the awareness of diaper pollution and the options available in cloth nappies.

Cloth Nappies

The cloth napkin is a piece of textile made from natural fiber like cotton and used on the baby with folding. Once soiled they are removed and washed, dried for used again (Figure 1). Cloth nappies are known for very good ventilation and lack of dyes in them making it semi sustainable. They are comfortable, cool on baby, convenient, and cost-effective. In some countries, the old textiles are recycled into napkins which is a logical way to reduce pollution from households. The biggest advantage is that these can be used for the longest period of six to eight months by the repeated wash-sterilize-dry method. Some of the consumers prefer using a plastic wrap over the cloth napkin to prevent getting wet and some others prefer napkin to be pre-folded and ironed ready for use. Besides some consumers feel that during the washing of cloth napkins detergents and electricity consumption is unavoidable, compared to the plastic pollution caused by diapers the cloth napkins are a better choice. The aesthetics are low on a cloth napkin compared to a diaper especially while taking the child to out or events.

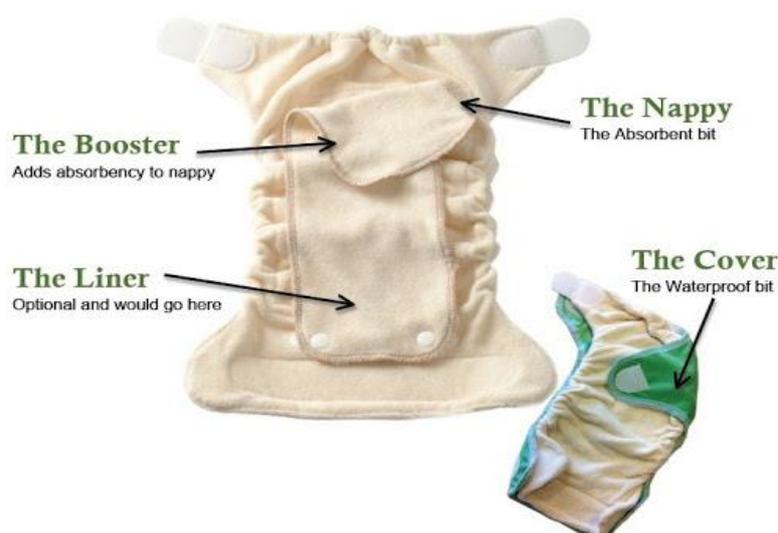


Figure 1. Cloth nappy

Types of nappies/ diapers

a. Standard disposable diapers: These are made of layers of plastic and paper long with gels to absorb the wee and poo of the baby.

b. Biodegradable disposables: It is a category that is easily flushable in a sewage system on flushing. This is used to avoid landfill pollution, and it assured to decompose in 90-150 days or 80 days when used in a composter.

Cloth diapers are good for the environment. They can save time and money. The advantages of using cloth napkins are its convenience to use, ease in the process, economical, environmentally safe, healthy for the baby, and washable. However, there are different types to suit different consumer choices which are discussed below;

1. Flat nappy is the cover or wrap that goes over the top of the fitted cloth nappy to provide a waterproof layer. Cheap to buy and long-lasting, it has velcro, poppers, or ties like fastening. These include the traditional terry towels that are used based on “pre-folds”. The commonly used fibers are organic cotton or unbleached bamboo. The flat nappy requires a waterproof cover that is usually made of polyurethane laminate (PUL), polyester, fleece, or wool. As a traditional practice terry towel, flannelette or muslins are used for newborn babies are used in a folded fashion which is pinned or fastened with a snap. (Figure 2.a)



Figure 2.a. Flat Nappy 2.b.Prefolds

2. Pre-folds are flat nappies that are already folded ready to be inserted into waterproof breathable pants. The cover is a layer that goes overfold of a fitted diaper to make it work efficiently and is made of polyurethane laminate, wool, and fleece. (Figure 2.b)



Figure 3.a Fitted Cloth nappy 3.b. All in one diaper

3. Fitted cloth nappies or cloth diapers: These are replicas to the disposable nappies having elastic at the legs, Velcro, no requirement for folding or pinning. Some brands have one universal size for all and others make sized based fitted nappies. This is easy to use cloth nappy that can be laundered, reusable, and looks like a diaper. The fitted nappy is absorbable and needs a waterproof cover. The main parts are a) the absorbent shaped nappy b) a booster for increased absorbency, for heavy wetting and overnight use c) a liner closest to the skin which creates a dry layer between the skin and nappy. They are available as a) sized nappies - usually three or four sizes, according to the weight of the child. b) one size nappies - with adjustability to fit child from newborn to toilet training stage (Figure 3.a).

4. All in ones are made up of the waterproof cover and the insert is made of cotton. The entire piece can be laundered in a washing machine which them great for repeated use and more sustainable. They either have the booster built into the body of the nappy or they have snapped-in boosters that can usually be interchanged to extend the wear of your nappy. Pocket all in ones are covered with two layers and an opening in the back insert a prefold or doublers/booster. This is also a fast and convenient option (Figure 3.b)

5. Shaped nappies are based on cotton and have a shape that fits the baby well. They have a separate waterproof breathable pant. The cotton pad goes for laundry and the outer pants will not need frequent laundry (Figure 4.a).

6 Pocket nappies or stuffable nappies: These have a waterproof wrap with a built-in pocket. This is stuffed with super absorbent inserts made from bamboo, micro-fiber, or hemp that can be used one-piece or multiple ones depending on the need (Figure 4.b).



Figure 4.a Shaped nappy 4.b. Pocket nappy

Disposable Diaper

Diapers are nonwoven made as a sandwich of layers that are made of plastic to prevent leaking keep the baby skin dry. It is popular for the comfort it can offer to the wearer and mother. The sleep-deprived newborn mother feels comfortable when diapers are on the baby to make them sleep without wetness breaks for longer hours. Perhaps, many babies are exposed to excessive time, resulting in fungal infection, rashes, and irritated skin surface. Use and throw is the biggest alluring factor of a diaper as the dirty material is disposed of once for all. If this is biodegradable they naturally tend to decompose on the soil. In the case of the existing diapers which are based on plastics, they fail to blend or go back to nature. Diapers are very expensive compared to cloth napkins. The advantages of the diaper are its ultra-dry (with three layers), baby snuggling, protection against leakage, contour shape, and comfort for the baby. However potty training of the baby is delayed which is a setback in the case of diapers.

Plastics from its inception have been widespread and the first formed fragments are still in the chain, undecomposed. This has various side effects of plastic causing soil leaching and entering the human body through air, water, and soil. It is also hazardous to babies. One of the major reasons for the development of rashes is because the baby urine and stool react with a diaper, causes the skin to crack or develop blisters. Ninety percent of the diapers end up in landfills and not incinerated or buried as in few practices. In a country like Australia with limited land space or any other country where land is vital for industrial development, it is a bad choice to use to dump with non-bio-degradable wastes. Besides diapers are loaded with toxic chemicals that can affect the health and future of the baby.

Diapers are used not just for babies, but for aging populations, or patients who are bedridden and unable to take care of themselves. It would be convenient in these cases for a caregiver to be notified that a patient, particularly in a multibed hospital, needs changing. Today, diapers are integrated with technology, using sensors, electronics and intelligent materials that

increases the functionality. The researches at Massachusetts Institute of Technology have developed a tiny Radio-frequency identification (RFID) sensor that can detect diaper moisture, signal a nearby receiver, and send caregivers an alert, reports. They say that the sensor can be manufactured for less than 2 cents, making it suitable for disposable diapers without adding bulk. Similarly, a low-cost “smart” diaper can notify the caregiver when it’s wet. It’s a combination of electronics, computers, and textiles. When the sensor detects dampness in the diaper, it sends a signal to a nearby receiver, which in turn can send a notification to a smartphone or computer. The sensor consists of a passive radio frequency identification (RFID) tag, that is placed below a layer of super absorbent polymer, a type of hydrogel that is typically used in diapers to soak up moisture. When the hydrogel is wet, the material expands and becomes slightly conductive to trigger the RFID tag to send a radio signal to an RFID reader up to 1 meter away.

Over time, smart diapers may help record and identify certain health problems, such as signs of constipation or incontinence. The new sensor may be especially useful for nurses working in neonatal units and caring for multiple babies at a time.

Diaper recycling methods



Figure. 5. Methods to reduce waste disposal

Diaper absorbent layer are made of cotton, hemp, starch, bamboo and as an absorbent item its function is to hold the urine and faeces of the baby. This after soiled can be easily degraded in few weeks. As a matter of convenience over sustainability, diaper is packed with water resistant material like polyester, which is plastic and made from petrochemical derivatives, help in preventing leakage. This aspect is dangerous and affect the life and ecosystem. Eco-friendly initiatives are done by replacing the bleached cotton by starch, but still the plastic layer along with fragrance, furans, dyes, dioxins are intriguing. Diapers are usually flushed in the toilets, composted into manure, incinerated or thrown in landfills. Preventing the use of synthetic material, reuse of the cloth nappies, recovery and disposal, along with reduction of disposable diaper is the solution (Figure 5). There are other major treatments which are discussed below.

1. Mechanical-biological treatment (MBT):

In this process, the diapers are screened by manual separation, sieving, or Foucault separation. Bulky materials are sorted and the remaining waste is subjected to biological treatment including both aerobic and anaerobic types. The compost obtained from the treatment is stabilized, where there is a reduction in volume and is of low moisture and used on the plants.

2 Mechanical separation and recycling of the different fractions:

The cellulose, organic matter, inorganic matter, super absorbent polymer, and various other components are separated for possessing. On transporting to the recycling site, they are shredded, washed, and separated, resulting in different wastes to be treated differently. This is an expensive process but 84% of landfill pollution can be halted [1]

Sustainable Solution - Compostable diapers

Degradability is the ability to be able to breakdown and decompose. They are of three types namely bio-degradable, non-biodegradable and oxo- bio-degradable (Figure 6). Diapers are made with organic fibres, degrade into nature or in some cases recycled. Some brands manufacture 100 percent natural fibre-based diapers, that on disposal degrade into the soil and become a compost [2]. In other cases, the outer polythene layer is separated and the organic part is subjected to composting (Figure 7). The use of compostable diapers is a real alternative to disposable diapers as no technical problems have been observed and a significant amount of organic matter can be recovered. Even though various brands are available the compostable diapers have few drawback interms of higher cost and appropriate evidence to support its eco-friendly nature. The baby health and comfort plays a major role in selection of nappies of diaper.

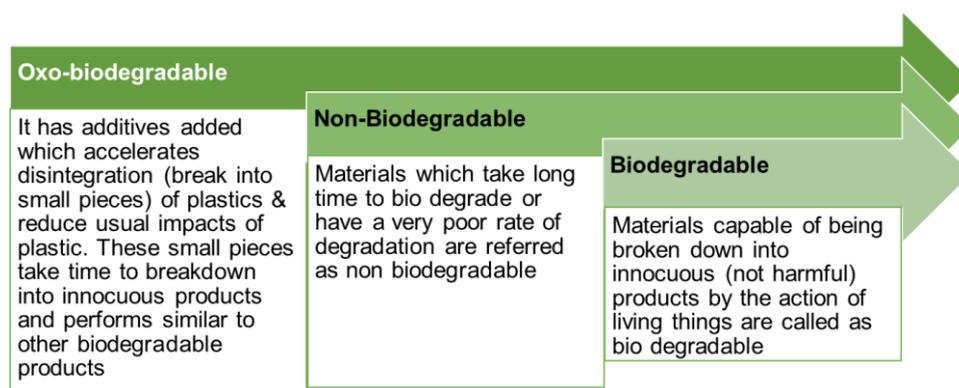


Figure 6. Types of Degradability

Nevertheless, a complete LCA of all the processes in terms of sustainability and environmental impact and a rigorous economic analysis should be the object of further studies to confirm the suitability of this emerging option [3]. A group studied the possibilities for the management of disposable diapers in municipal solid waste. OFMSW – Organic Fraction of Solid Waste is used as feedstock (raw material /fuel) for Anaerobic digestion (extraction of biogas from compost). It includes food waste, grass clipping flower trimmings & yard wastes. OFMSW has 3%

compostable diapers and 50% carbon of compostable diapers is emitted as carbon dioxide under aerobic conditions. No alterations are detected with or without diapers. No pathogenic (infectious micro-organisms) were detected. Some say it may form an effective transform way into high-quality compost. However, compost coming from OFMSW with 3% of disposable diapers presented a slightly higher level of zinc, which can prevent the use of large amounts of diapers mixed with OFMSW [4]. Huggies & Evicorp established the first commercial nappy composting facility in Christchurch (New Zealand). In the first year, they have processed more than 15,000 diapers/day. These processed diapers were extracted from the mixture of green waste supplied by the local councils. The resulted compost was suitable for commercial gardening/ landscaping. This sponsorship reinforces our commitment to continuously seek innovative solutions to demonstrate how to collect and process Kimberly-Clark's post-consumer diaper waste and thus reduce the environmental footprint of our products [5].



Figure 7. Compostable diaper

Cloth Nappies over Disposable Diaper

The diapers are made of polyester, super-absorbent chemicals, paper pulp, and plastics. Whereas cloth nappies are made of natural fibers and sometimes coated with regional leaf (neem, aloe vera, tea), root (turmeric), flower extracts (marigold) for antimicrobial coating. India being the land of herbs has a huge collection of herbs that have disinfectant properties. These finishes are commonly done in sanitary napkins but least in baby diapers as they have to get clearance from the ethical committee and organic certification. The concept of nappy pad making and the herbal finishing can be demonstrated to the Self-help groups and suggested as a source of income to them.

Sustainable solutions to make eco-friendly diaper

The global market for disposable diapers is expected to grow at a CAGR of 10.3% by the end of 2024. In an era where green consumerism is more focused, diaper pollution is alarming. Besides, some choices can be made, which can offer a better choice to the baby. Some napkins are made fashionable and functional. Denim print diapers, color-changing nappies are popular.

However, sustainability is the need of the hour, diapers made from renewable materials like bamboo can be an effective alternative to conventional plastic-based diapers. It is made from pine plantation wastes called “thinnings” are used in the stuffing pinewood [renewable fiber]. Similarly, agrowastes like banana, corn, soy, bagasse, can be made into eco-friendly diapers, avoiding chemicals as much as possible. Unbleached cotton can be used in the absorbent core. The diapers that are biodegradable, flushable, or made with renewable organic materials can be designed for the future to make recommendable. This can be done by reducing the particle size coupled with minimum pressure bonding as in core-sheath. Such materials on agitation in a toilet flush on exposure to water easily diffuses without clogging the pores of sewage. Later they degrade with the wastewater due to their biodegradable nature. The diaper collecting units/factories can be installed to collect used diapers and make compost, vermicompost to work as a soil enhancer [6].

Conclusion

Today, both cloth nappies and disposable diapers are used. Statistically people are inclined to use diapers, which is seen on increase in sales reports of diapers every year. These diapers are a threat to nature as most of them end on landfill as pollution. Man tries to explore the land as a means of modernisation and expansion of resources, and we cannot afford to use them for stocking wastes. The various problems associated with an unused waste on an open land is huge and dangerous on the first hand. The paper dealt with cloth nappies and its types and significance along with disposable diapers. It is an individual responsibility to use them with a thought of sustainability in future. To balance the usage of cloth and diaper, shifting entirely to reusable nappies or upcycling old materials to cloth pads can be effective means to combat the pollution.

References

1. <https://core.ac.uk/reader/78543701>
2. <https://core.ac.uk/reader/189877546>
3. <https://www.instructables.com/id/Recycle-Diapers-into-Great-Compost/>
4. <https://www.ncbi.nlm.nih.gov/pubmed/20406752>
5. <https://www.technicaltextile.net/news/composting-facilities-for-disposable-diapers-new-zealand-143328.html>
6. <http://news.mit.edu/2020/smart-diaper-rfid-notify-caregiver-0214>