

Disposable Sanitary Waste Management in India

A Systems Perspective on Diaper Waste and Disposal

Research Findings from The Design Village x UCL Plastic Waste Innovation Hub Collaboration

This report presents a synthesis of research conducted by The Design Village in collaboration with the Big Toilet Project, UCL Plastic Waste Innovation Hub, examining disposable sanitary waste within the Indian context.

Drawing on qualitative interviews, field observations, systems mapping, and secondary research, the study investigates the lifecycle of disposable diapers from production and use to disposal, collection, and end-of-life management. Rather than viewing diaper waste solely as a material issue, the research adopts a systems perspective, recognising the interconnected roles of caregiving practices, consumer behaviour, municipal infrastructure & policy.

Across the research, four recurring findings emerged:

1. Changing caregiving practices have extended diaper dependency and increased sanitary waste generation.
2. Current waste systems prioritise removal rather than recovery, limiting opportunities for segregation and recycling.
3. The burden of unsafe disposal falls disproportionately on sanitation workers and informal waste handlers.
4. The greatest opportunity for intervention exists at the point of disposal, before waste enters the mixed municipal waste stream.

These findings identify opportunities for improving waste identification, segregation, worker safety, and behaviour change, while informing future research and policy. This version restores the interview quotes, worker testimony, and cultural context that sit behind each finding, so the evidence supporting these conclusions is visible alongside them.

Research team

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1. Introduction & Context

1.1 About the Collaboration

This report presents the findings of a collaborative research initiative between The Design Village (TDV) and the Big Toilet Project, part of the UCL Plastic Waste Innovation Hub, University College London.

The Design Village is a transdisciplinary design institution that integrates education, research, and industry collaboration to address complex societal challenges through practice-based learning.

The Big Toilet Project investigates changing toilet-training practices and their relationship to plastic waste generation globally, an online citizen-science initiative gathering toilet-training data from households internationally to help advise governments on reducing diaper-related plastic pollution.

Together, the collaboration examined disposable sanitary waste in India through a systems lens to better understand the behavioural, environmental, infrastructural, and policy dimensions shaping its management.

1.2 Research Objective

The study sought to:

- Understand current disposal practices and stakeholder behaviours.
- Map the lifecycle and flow of disposable sanitary waste.
- Identify systemic barriers to segregation, recovery, and safe handling.
- Generate evidence to inform future design, policy, and behavioural interventions.

1.2 Methodology

The report synthesises findings from multiple student-led research studies conducted under a shared research framework. Methods included:

1. Semi-structured interviews
2. Field observations
3. Site visits
4. Systems mapping
5. Stakeholder mapping
6. Secondary research and literature review

A full summary of sample sizes, sites, and duration is provided in Annexure B

2. Understanding the Problem

Disposable diapers have become an essential part of modern caregiving due to their convenience, hygiene, and accessibility. However, increasing dependence on disposable products has also created a rapidly growing waste stream.

Children are being toilet trained significantly later than in previous generations, extending the period of diaper use and increasing waste generation. This shift reflects broader changes in caregiving, including urbanisation, dual-income households, and convenience-oriented parenting.

A Cultural Shift in Caregiving

Alongside this delay, the research traced a broader shift in Indian childcare practice. From resource-conscious, routine-based caregiving toward convenience-driven caregiving:

- a. **Traditional practice:** reusable cloth nappies washed and reused at home; earlier toilet training; cue-based parenting responsive to a child's natural signals; lower overall consumption; resulting in minimal sanitary waste generation.
- b. **Contemporary/urban practice:** single-use disposable diapers; delayed toilet training; convenience-oriented, time-saving parenting; high-consumption, low-reusability products; resulting in higher waste generation, with more diapers entering the waste stream.

Scale of the Problem

Biswas and Tewari (2022, p. 8) estimated that India generated approximately 548 tonnes of baby-diaper waste per day, equivalent to about 200,000 tonnes annually.¹ While The Indian adult diaper market is projected to grow at a compound annual growth rate (CAGR) of 11.12% between 2025 and 2030, driven partly by the country's growing elderly population (TechSci Research, 2025)².

Disposable diapers contain bonded layers of cellulose pulp, plastics such as polyethylene, superabsorbent polymers, adhesives, and elastics. Their composite structure makes material recovery difficult, while the plastic and superabsorbent components may persist in landfills for several centuries, commonly estimated at up to about 500 years (Płotka-Wasyłka et al., 2022, p. 3)³.

Despite the scale of the problem, disposable diapers continue to enter mixed municipal waste streams, where opportunities for segregation and recovery rapidly decline. Most used diapers are discarded as mixed waste, frequently concealed within plastic bags due to concerns around hygiene, cleanliness, privacy, and social stigma. A practice that renders diaper waste functionally invisible almost immediately after disposal.

3. The Current Waste System

The research mapped the complete journey of a disposable diaper from manufacture and purchase to disposal, collection, transportation, and final processing.

After use, diapers are typically wrapped and discarded with mixed household waste. Collection is undertaken by municipal services or informal waste pickers before waste is transported to transfer stations, dump-yards, or landfill sites. Although existing regulations - *Solid Waste Management (SWM) Rules, 2016*, mandate that soiled items such as napkins and diapers be wrapped securely and collected separately, and encourage separate handling of sanitary waste, implementation remains inconsistent, and dedicated recovery pathways are limited.

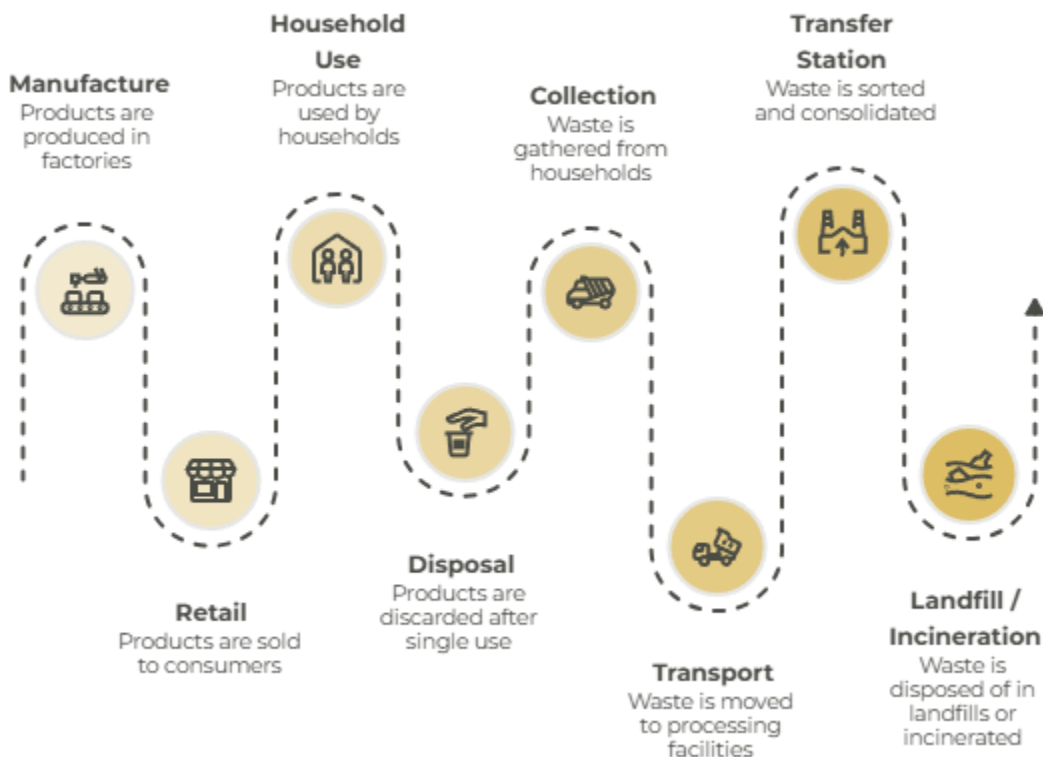


Figure 3.1 — Journey of a Disposable Diaper through the Current Waste System

The waste system involves multiple interconnected stakeholders including caregivers, manufacturers, retailers, municipal authorities, sanitation workers, waste pickers, recyclers, and policymakers. The research also identified stray animals as an active component of the waste ecosystem, contributing to contamination before collection.



Figure 3.2 Stakeholder Ecosystem of Disposable Sanitary Waste

Overall, the current system is designed primarily to remove waste from public view rather than preserve materials for recovery. This mismatch is visible most clearly in the gap between where segregation is intended and where it actually breaks down:

Disposal Routes

Landfill: the most common disposal route for mixed municipal waste, including sanitary waste.

Incineration: reduces waste volume but requires significant energy input; mixed or improperly segregated waste, when incinerated, can release dioxins, heavy metals and particulate matter, which is why incineration machinery is subject to inspection and certification by the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs).

Open dumping: observed within some existing waste systems, particularly where formal infrastructure is limited.

Dedicated recovery facilities: present in principle, but limited in number and often inaccessible for sanitary waste specifically.

Existing Product Landscape

Secondary and market research compared the strengths and limitations of the main diaper product categories currently available to Indian consumers:

	Product	Strength	Limitation
	Disposable (conventional) diaper	Convenient, widely available, high absorbency	High plastic content; whole product becomes waste; long decomposition period
	Cloth / reusable diaper	Reusable, washable, lower overall waste generation	Frequent washing, drying and storage required; perceived as less convenient; can leak more
	Biodegradable diaper	Reduced reliance on conventional plastics	Can still contain significant plastic content; decomposition still slow and condition-dependent
	Compostable diaper	Reduced plastic usage; supports circular waste systems	Requires a correct, specific disposal/composting pathway; low user awareness; frequently confused with biodegradable
	Diaper liner / disposal bag	Helps contain waste and control smell/privacy	Does not by itself reduce diaper material waste

Table 3.1

Brand-level research found that established disposable-diaper brands such as Pampers (launched 1961, Procter & Gamble) popularised single-use diapers on the basis of comfort, hygiene and convenience, but have also been criticised for contributing to plastic waste and landfill pollution. More recent entrants positioned around sustainability, such as Mamaearth (founded 2016), market toxin-free or biodegradable formulations; research noted that packaging waste and production footprint concerns persist even for these brands. A grassroots identification initiative called *the Red Dot Initiative* was also identified, in which used sanitary items are wrapped and marked with a red dot so waste collectors can recognise and handle them with appropriate precaution; adoption of such marking-based initiatives was found to remain limited in practice.

4. Research Findings

Disposal is Driven by Convenience

Caregivers prioritise hygiene, odour control, privacy, and convenience when disposing of diapers. Most participants reported limited awareness of downstream waste-management processes and had received little guidance on appropriate disposal methods.

Distinct caregiver profiles emerged across interviews:

1. caregivers who actively chose cloth nappies for their affordability and reusability, emphasising the importance of regular washing and hygiene;
2. caregivers (particularly single & working mothers) for whom disposable diapers were described not as a preference but as a necessity, since balancing paid work and childcare left little time for washing cloth nappies, despite awareness of their cost and environmental drawbacks; and caregivers whose attitudes were shaped largely by social-media influencers and medical advice rather than by direct personal experience. Despite limited awareness,
3. caregivers across multiple interviews expressed willingness to adopt better disposal practices provided the process remained simple and did not significantly add to their existing routine; some specifically noted that incentives or rewards could further encourage participation.

Waste Becomes Invisible After Disposal

Wrapping diapers before disposal conceals sanitary waste almost immediately, making it difficult to identify, segregate, or recover later in the waste stream. This invisibility extends beyond physical waste, as sanitary waste is rarely monitored as a separate category.

Research found that this behaviour is governed less by formal rules than by social norms around **privacy**, **shame**, and **perceived hygiene**. Waste associated with bodily fluids is widely viewed as impure within household cultural norms; cleanliness is prioritised inside the home, while a household's sense of responsibility for the waste decreases sharply once it leaves the home. Effectively “out of sight, out of mind.” Caregiver’s own words captured this directly:

“Hum bas phak dete hain” (We usually just throw it away with the rest of the household waste.)

“It smells.”

“It may leak.”

“It feels unhygienic.”

“It should not be visible.”

“It feels wrong to throw directly.”

The Burden Shifts Downstream

Sanitation workers, waste pickers, and landfill staff experience the greatest exposure to contaminated sanitary waste despite having no influence over household disposal decisions.

Workers consistently reported handling mixed waste with limited protective equipment, while diapers carry little or no recovery value within the informal recycling economy. Worker interviews converged on a consistent set of findings, captured directly in workers' own words:

"Sab mixed hi aata hai" (All types of waste are mixed when it arrives.)

"We cannot tell which diaper is compostable and which is not."

"Phir alag karna mushkil ho jaata hai" (After that, separating it becomes difficult.)

"Diaper ka koi resale value nahi hota" (Diapers have no resale value.)

Lack of implementation of worker-safety practices was attributed to limited financial resources and inadequate training, and was linked in interviews to chronic respiratory issues, skin infections, infections from sharps, musculoskeletal injuries, and high stress among workers.

Despite these conditions, workers indicated that a visible identification system on sanitary waste would likely make collection safer. Suggesting support for interventions that do not add to their existing manual workload.

A distinct line of worker-led research surfaced the role of stray animals at collection points. Waste collectors and sanitation workers reported that stray dogs regularly (in some accounts, nightly) tear open garbage bags containing diaper waste in search of food:

"Kutte kabhi kabhi disposed diapers phaad dete hain" (Dogs sometimes tear open disposed diapers.)

Researchers found that waste in Indian cities often remains accessible in public space (open community bins, roadside storage, temporary dumping points) for extended periods before formal collection, allowing stray dogs, cattle, pigs and birds to interact with it routinely. This was characterised as a structurally embedded feature of the Indian waste-management landscape, not an isolated nuisance: torn bags scatter waste, increase contamination, and expose absorbent material before it can be sorted, reducing what can later be recovered.

Recovery is Systemically Constrained

The research found that poor recovery outcomes result from the interaction of material composition, disposal behaviour, and infrastructure limitations. Even compostable or biodegradable diapers typically follow the same disposal pathway as conventional products because they are visually indistinguishable after use.

A sustainable product can only create impact when it is disposed of correctly. Because compostable, biodegradable, and conventional diapers look essentially identical once unwrapped, both households and waste workers were found to make disposal decisions based on visual appearance rather than underlying material composition.

Category	Advantages Identified	Challenges Identified
Conventional / disposable	Easily available; high absorbency; convenient	High plastic content; long decomposition period; significant landfill contribution
Biodegradable	Reduced reliance on conventional plastics	Can still contain significant plastic content; continues to contribute to landfill if not specially processed
Compostable	Reduced plastic usage; supports circular waste systems	Requires a correct, specific disposal/composting pathway; low user awareness; frequently confused with biodegradable

Table 4.1

Household Structure and Diaper Dependency

Household composition and caregiving capacity were found to materially affect both diaper use and toilet-training timing:

Households where both parents work full-time:

limited caregiver time → high diaper dependence → reduced awareness of the child's wetness cues → delayed toilet training

Households with one parent primarily at home:

more direct, continuous caregiving → moderate diaper use → slightly earlier training

Joint-family households with multiple caregivers:

near-constant attention → minimal diaper use → earliest toilet training

External influences repeatedly cited as shaping these household patterns included social media and parenting blogs, doctor and medical recommendations, urbanisation and changing lifestyles, the influence of internet culture among younger (Gen Z) parents, and the time constraints faced by working parents. Fathers were found to participate more in product purchase decisions than in the physical labour of changing or disposing of diapers, a gendered division of caregiving labour that recurs throughout the findings above.

Cultural History: Cloth Nappies and Traditional Practice

Secondary and cultural research traced the historical use of reusable cloth nappies in India, made from materials including cotton, muslin, mulmul, old saree fabric, dhoti cloth, and soft towels. These were favoured for being breathable, containing fewer synthetic chemicals, and supporting earlier toilet-training awareness. Reasons cited for their traditional prevalence included affordability and reuse of existing household fabrics, suitability for a hot, humid climate, established household familiarity with washing and sun-drying, and the additional labour support that joint-family caregiving structures provided. Comparable patterns of traditional cloth-wrapping practice were noted in other countries with similar climates, including Bangladesh, parts of Africa, and Sri Lanka.

At the same time, research identified clear limitations that contributed to the shift away from cloth nappies: the washing, drying and storage they require increases domestic labour and time for caregivers; washing consumes water, detergent and electricity; they may leak more, causing more frequent changing while travelling or at night; and modern lifestyles that prioritise speed and mobility tend to perceive cloth nappies as comparatively time-consuming. Cloth nappies were also found to make caregiving labour physically visible, since soiled fabric must be cleaned and repeatedly washed, in contrast to the instant concealment offered by disposable diapers.

Health Considerations Linked to Material Choice

Secondary research into the effects of prolonged diaper use identified several recurring conditions: diaper rash, caused by trapped moisture, heat, friction, and prolonged exposure to urine and faecal matter; Candida (fungal) infection, promoted by warm, damp conditions; skin irritation and allergic reactions linked to fragrances, dyes, adhesives, and absorbent gels; overheating and breathability concerns, which can disturb sleep and increase skin sensitivity; and delayed toilet training, attributed to prolonged diaper dependency reducing a child's awareness of wetness and bladder signals.

5. Key Research Insights

The research identifies several systemic insights:

1. Disposal represents the final point at which users retain meaningful control over a diaper's environmental outcome.
2. Convenience consistently outweighs sustainability in household disposal decisions.
3. Sanitary waste becomes operationally invisible almost immediately after disposal.
4. The greatest health risks are transferred to downstream waste workers, who have no influence over the household decisions that create the risk.
5. Existing infrastructure prioritises waste removal rather than material recovery.
6. Material innovation alone cannot improve environmental outcomes without corresponding disposal systems — compostable and biodegradable products are only as effective as the disposal pathway they actually travel through.
7. Animal interaction with exposed waste at collection points is a structural, recurring feature of Indian urban sanitation systems, not an isolated incident.
8. A gendered division of labour means the practical burden of diaper-related disposal work falls disproportionately on mothers and female caregivers.

6. Systemic Gaps & Opportunity Areas

The research identified four interconnected gaps:

1. Segregation Gap: sanitary waste is routinely mixed with household waste.
2. Identification Gap: waste cannot be distinguished once discarded.
3. Awareness Gap: limited public understanding of disposal practices.

4. Traceability Gap: sanitary waste is not monitored through the waste system.

These findings suggest opportunities to:

1. Improve waste identification.
2. Create dedicated disposal pathways.
3. Support safer handling for sanitation workers.
4. Strengthen public awareness.
5. Enhance material recovery infrastructure.
6. Align policy with everyday disposal practices.

Conclusion

Disposable sanitary waste is not simply a product or materials challenge; it is a systems challenge shaped by the interaction of caregiving practices, consumer behaviour, infrastructure, policy, and material recovery.

By consolidating evidence from multiple studies, this report demonstrates that improving outcomes will require interventions across the entire lifecycle of disposable sanitary products. Addressing only materials or disposal technologies is unlikely to achieve meaningful impact unless accompanied by changes in behaviour, infrastructure, and governance.

The findings presented here provide an evidence base for future research, policy development, and design-led innovation aimed at creating more sustainable and equitable sanitary waste systems.

Annexure A: Source

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