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Scented Sanitary Pads as an Emerging Public Health Concern in Bangladesh: Evidence on Chemical Exposure and Reported Gynecological Symptoms

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ORIGINAL ARTICLE

Abstract:
Menstrual Hygiene Management (MHM) is a vital public health issue that affects the empowerment, well-being, and dignity of women and girls worldwide. Sanitary pads (menstrual pads) are an important component of menstrual hygiene practices. Despite rising global awareness of the probable health risks related with synthetic chemicals in menstrual products, Bangladesh remains a setting where such products are comparatively poorly regulated and may contain various chemical additives, potentially posing greater risks to low-income women with limited access to safer alternatives. Scented sanitary pads have appeared as a growing class of menstrual hygiene products in Bangladesh; however, they remain among the least regulated and least studied products in terms of chemical exposure and gynecological care. Their mounting popularity reflects not only the expansion of the menstrual hygiene market but also sociocultural pressures to conceal menstrual odor, thereby reinforcing persistent menstrual stigma. Fragranced sanitary pads contain a range of volatile and semi-volatile chemicals, including limonene, linalool, benzyl salicylate, diethyl phthalate, aldehydes, synthetic musk, etc. Some of these have been allied with allergenic, irritant, endocrine-disrupting, and microbiome-altering effects. Due to high permeability of the vulvovaginal epithelium, repeated exposure to fragranced menstrual products may upset body's natural defenses, facilitate chemical absorption, and potentially rise toxicological risks. These concerns are mostly relevant for adolescents and low-income women in Bangladesh, whose use of scented products may be influenced by social potentials regarding menstrual hygiene and odor control. This review synthesizes current evidence on fragrance chemistry, toxicological mechanisms, organic effects, sociocultural factors, and public health implications related with scented sanitary pad use in Bangladesh, with particular emphasis on potential dermatological, microbiological, endocrine, and reproductive health consequences. It also highlights regulatory gaps and the need for compulsory ingredient disclosure, inclusive menstrual health education, and improved access to safer, fragrance-free menstrual hygiene products.

***Keywords*:** Scented sanitary pads; Menstrual hygiene; Fragrance chemicals; Women's health; Gynecological symptoms; Public health; Bangladesh.

Introduction:

Menstruation is a normal biological process, not something to hide. This biological process is experienced by women of reproductive age. But, in Bangladesh, it continues to be surrounded by stigma, secrecy, and taboos that influence menstrual hygiene practices and product preferences (Share-Net Bangladesh, 2025). In recent years, scented sanitary pads have become an increasingly popular menstrual hygiene products because they are marketed as effective solutions for masking menstrual odor and alleviating menstruation-related shame and embarrassment (BBS, 2022). Although marketed as enhancing freshness and hygiene, fragranced sanitary pads offer no established medical benefit though introducing extra chemical

exposure (Marroquin et al., 2024). Fragrance ingredients are incorporated into sanitary pads through microencapsulation, polymer coatings, or perfumed fibers, enabling their gradual release during product use (Park et al., 2019). These products usually contain complex mixtures of volatile and semi-volatile fragrance compounds, some of which have been identified as allergens, skin sensitizers, endocrine-disruptors, or reproductive toxicants (Upson et al., 2022).

Women in Bangladesh may be particularly vulnerable to potential health effects from fragranced menstrual products due to limited menstrual health education, persistent stigma, and inadequate regulatory oversight (Share-Net Bangladesh, 2025). Prolonged contact with scented sanitary pads increases chemical absorption due to the high permeability of vulvovaginal tissue, which is further influenced by the warm, humid, occluded conditions and friction associated with pad use and changes in vaginal pH during menstruation (Marroquin et al., 2024). Evidence indicates that lipophilic fragrance can be efficiently absorbed through vulvovaginal tissues, potentially increasing the risk of adverse dermatological outcomes, including vulvitis, erythema, pruritus, burning sensations, and allergic or contact dermatitis (Eason & Feldman, 1996). Fragranced products have also been associated with disruption of the vaginal microbiome through alterations in vaginal pH and depletion of protective *Lactobacillus* species, thereby increasing susceptibility to bacterial vaginosis and recurrent vulvovaginal candidiasis (Upson et al., 2022). Mounting acceptance of scented sanitary pads reflects socio-cultural insights that link menstrual odor with poor hygiene and social embarrassment (Share-Net Bangladesh, 2025). In response to consumer demand, manufacturers offer various fragrance profiles, including floral, fruity, herbal, musky, synthetic scent, etc. These formulations typically contain complex combinations of fragrance ingredients (e.g., limonene, linalool, geraniol, benzyl acetate, benzyl alcohol, diethyl phthalate, aromatic compounds), some of these are susceptible to oxidation and may form potent sensitizing products upon contact to air and heat (Park et al., 2019; Upson et al., 2022).

This review examines the potential health implications of scented sanitary pad use in Bangladesh by integrating evidence from toxicology, fragrance chemistry, reproductive biology, microbiology, and public health. It explores the mechanisms of chemical exposure, biological pathways underlying dermatological, microbiological, endocrinological, and reproductive effects, and the socio-cultural factors that contribute to widespread use of fragranced menstrual products. In addition, the review evaluates existing regulatory challenges and highlights the need for evidence-based policies, ingredient transparency, comprehensive menstrual health education, and greater access to fragrance-free menstrual hygiene products to promote safer menstrual health practices in Bangladesh (Share-Net Bangladesh, 2025; Marroquin et al., 2024; Upson et al., 2022).

World Demographics:

As of 16 September 2026, the global population is ~8.3 billion (Worldometer, n.d.); ~4.1 billion are female (World Sex Ratio 2026-StatisticsTimes.com, n.d.). ~1.8 billion people menstruate each month, with an ~0.8 billion women and girls menstruating on any given day (https://hub.sivo.it.com/, 2025).

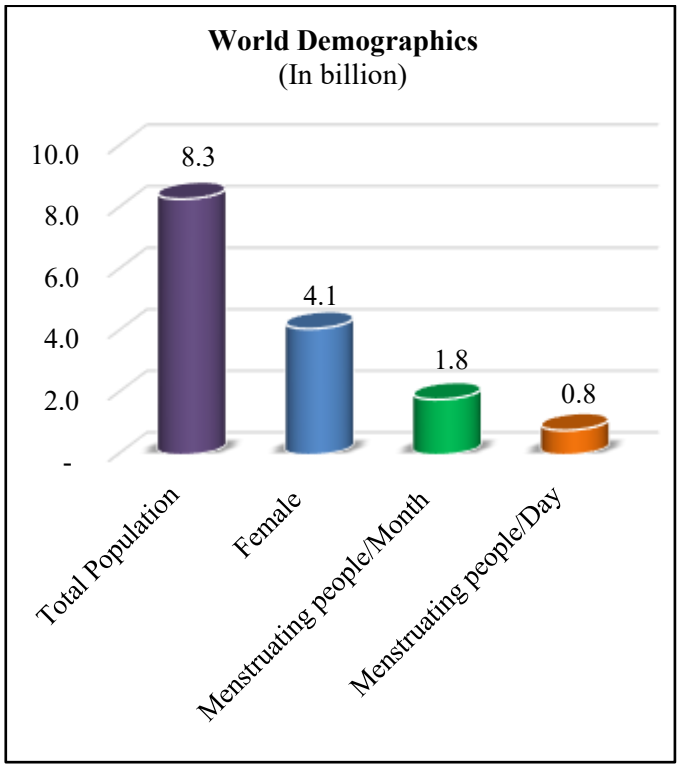


Figure 1: Global population is ~8.3 billion, of whom ~4.1 billion are female. ~1.8 billion people menstruate each month, with ~0.8 billion women and girls menstruating on any given day.

Bangladesh Demographics:

As of 16 September 2026, the population of Bangladesh is ~178.2 million (Worldometer, n.d.); ~90.4 million are female (World Population Review, 2026) and ~50.6 million females are of reproductive age (15-49 years) (Geo FactBook, 2026). Of the total population, ~43.2%

(76.8 million) live in urban areas, ~56.8% (101.0 million) live in rural areas (Worldometer, n.d.).

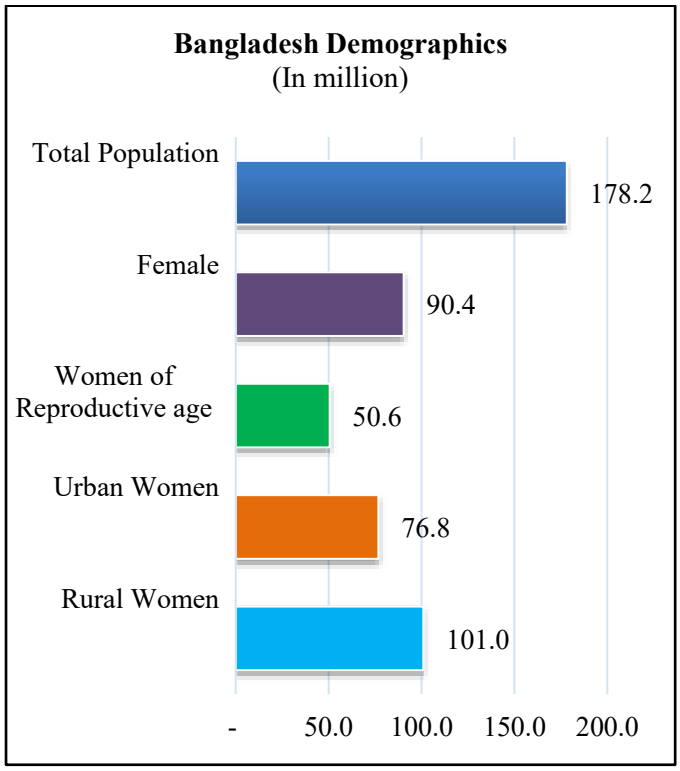


Figure 2: Bangladesh's total population is ~178.2 million, of whom ~90.4 million are female. ~50.6 million females are of reproductive age. ~76.8 million of the population live in urban areas, while ~101.0 million live in rural areas.

Socio-Cultural Context of Scented Sanitary Pad Use:
Bangladesh's socio-cultural environment plays a central role in shaping perceptions and management of menstruation, contributing to the widespread preference for scented sanitary pads among women and adolescent girls (Share-Net Bangladesh, 2025). Despite progress in health and gender equality, menstrual hygiene remains shrouded in stigma in many countries, including Bangladesh. Menstruation is frequently viewed as a private and stigmatized issue, with discussions discouraged within families, schools, and communities, resulting in limited menstrual health literacy and persistent misconceptions (BBS, 2022).

In Bangladesh, ~64% of girls are reportedly unaware of menstruation before menarche (The Front Page BD). According to the National Hygiene Survey 2018, ~29% of women and adolescent girls in Bangladesh use sanitary napkins during menstruation, while the remaining ~71% rely on other conventional menstrual hygiene methods (Ahmed & Akter, 2026). Study further reported that ~79.8% of rural women in Bangladesh use traditional menstrual hygiene products (CARE Bangladesh 2024).

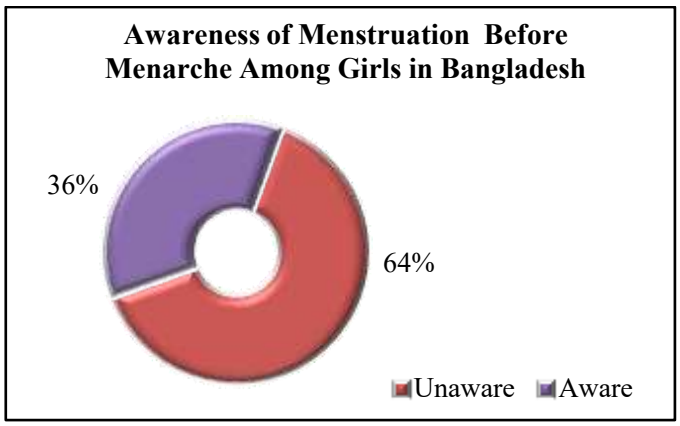


Figure 3: In Bangladesh, ~36% of girls knew about menstruation before menarche, while ~64% did not.

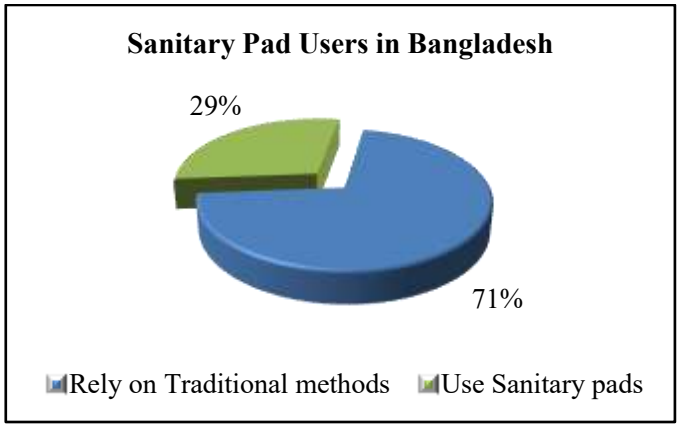


Figure 4: ~29% of women and adolescent girls in Bangladesh use sanitary napkins during menstruation, while the remaining ~71% rely on other conventional menstrual hygiene methods.

Hence, many women and adolescent girls become concerned about menstrual odor, leakage, and the visibility of menstruation, increasing their reliance on sanitary pads marketed as products that eliminate odor or provide 'all-day freshness' (Share-Net Bangladesh, 2025). Manufacturers capitalize on these concerns by promoting fragranced products with floral, fruity, herbal, and 'ultra-fresh' scent profiles (Park et al., 2019). Socio-cultural pressures are further reinforced by occupational and educational environments. In Bangladesh's garment sector, women often work in crowded settings with inadequate sanitation and limited menstrual care, which make concerns about menstrual odor a source of psychological stress. To avoid perceived embarrassment, many workers prefer scented sanitary pads (Upson et al., 2022). ~30% of adolescent girls in Bangladesh miss school for ~2.5 days/month during menstruation to avoid embarrassing incidents in class. Others choose strongly fragranced menstrual products marketed with appealing scents (UNICEF, 2022). These socio-environmental factors reinforce the perception that fragrance is essential for menstrual hygiene, despite

limited evidence of hygienic benefits and growing concerns about chemical exposure and health risks (Marroquin et al., 2024).

Socio-Cultural Drivers of Scented Sanitary Pad Use:

The widespread use of scented sanitary pads in Bangladesh reflects socio-cultural norms, gender expectations, workplace demands, and perceptions of menstruation. Menstruation is often treated as a private matter associated with impurity, discouraging open discussion of menstrual health (Share-Net Bangladesh, 2025). Consequently, many girls perceive menstrual odor as socially unacceptable, a perception reinforced by families, peers, educational institutions, and advertising (BBS, 2022). These socio-cultural perceptions influence menstrual hygiene practices and product preferences. Women and adolescent girls may fear being perceived as 'unclean' if menstrual odor is noticed, although menstrual blood normally has a mild metallic odor and does not require fragrance masking (Marroquin et al., 2024). Consequently, many adolescents prefer fragranced pads to reduce concerns about social embarrassment (Share-Net Bangladesh, 2025). Similar preferences are reported among women in garment factories, domestic service, and customer-facing jobs, where long working hours, close contact, and limited menstrual support may encourage fragranced product use (Upson et al., 2022).

Commercial advertising further reinforces these social expectations by portraying fragranced sanitary pads as symbols of cleanliness, confidence, social acceptance, and femininity (Park et al., 2019). In settings where comprehensive menstrual health education is limited, these marketing messages often become a primary source of information, reinforcing the misconception that fragrance is necessary for effective menstrual hygiene. Consequently, scented sanitary pads function not only as menstrual hygiene products but also as cultural symbols that reflect broader societal expectations regarding femininity, cleanliness, and menstrual concealment (Share-Net Bangladesh, 2025).

Chemical Exposure Pathways:

Chemical exposure from scented sanitary pads is influenced by their composition, including polymer-based materials, adhesives, superabsorbent gels, fragrance-coated fibers designed to release volatile organic compounds (VOCs) during use (Marroquin et al., 2024). Body heat, menstrual fluid, and sweat facilitate the release of fragrance ingredients such as limonene, geraniol, citral, coumarin, benzyl salicylate, diethyl phthalate into the vulvar environment (Upson et al., 2022). The warm, humid, and occlusive conditions during prolonged pad use further promote VOCs volatilization and dermal absorption of lipophilic chemicals (Park et al., 2019).

The vulvar epithelium is thinner and more permeable than keratinized skin, with rich vascularization that facilitates the absorption of environmental chemicals, particularly hydrophobic fragrance compounds that readily cross lipid membranes (Marroquin et al., 2024). Because scented sanitary pads remain in prolonged contact with the vulvar region, they may increase dermal exposure to fragrance constituents. One study detected phthalates in 86% of feminine care products and 98% of sanitary napkins tested. Phthalates can disrupt endocrine signaling and have been associated with hormonal disturbances and adverse reproductive and metabolic outcomes, including infertility and PCOS (Gao et al., 2019). Many of these compounds undergo oxidation or metabolic transformation into more reactive intermediates capable of damaging cellular structures (Upson et al., 2022). Oxidized terpene derivatives can form protein adducts within the skin, triggering inflammatory cytokine responses that contribute to allergic contact dermatitis and chronic vulvar inflammation (Eason & Feldman, 1996).

Fragrance composition varies by scent profile but may contain chemicals with toxicological concerns. Floral fragrances often contain monoterpenes such as linalool and limonene, which may become more allergenic after oxidation in humid conditions (Park et al., 2019). Fruity fragrances may contain compounds such as citral and benzyl acetate that can oxidize into sensitizing substances (Upson et al., 2022). Herbal formulations containing aloe vera, neem, tulsi, rosemary, or sandalwood may contain volatile plant compounds that could affect vaginal acidity and the protective *Lactobacillus* microbiome (Marroquin et al., 2024). Synthetic fragrances marketed as 'fresh or cool' may contain synthetic musks such as galaxolide and tonalide, along with petroleum-derived solvents and fixatives that prolong chemical persistence on the skin (Park et al., 2019). These lipophilic compounds may accumulate in tissues and exhibit endocrine-disrupting properties, raising concerns about repeated exposure (Upson et al., 2022). In Bangladesh, menstrual stigma may promote long-term use of fragranced pads, potentially increasing

cumulative exposure over the reproductive lifespan (Share-Net Bangladesh, 2025).

Chemical exposure may extend beyond localized dermal effects. Due to the vascularity of the vulvovaginal region, lipophilic compounds such as diethyl phthalate and synthetic musks may enter systemic circulation and partially bypass first-pass metabolism. Biomonitoring studies have detected phthalate metabolites in women using fragranced personal care products, supporting systemic absorption (Hussain et al., 2005; Gao et al., 2019). Overall, scented sanitary pads may contribute to repeated exposure to fragrance chemicals and endocrine-disrupting compounds, highlighting the need for further research on their long-term reproductive and systemic health effects.

Potential Health Effects of Scented Sanitary Pads:
Adverse health effects may arise through several mechanisms, including chemical irritation, allergic responses, microbiome disruption, endocrine activity, and repeated exposure to fragrance-related chemicals.

Contact with fragrance constituents may cause erythema, pruritus, burning, edema, and irritation. Oxidized compounds such as linalool, limonene, and citral can form hapten-protein complexes and trigger immune responses associated with allergic contact dermatitis (Eason & Feldman, 1996; Marroquin et al., 2024). Fragrance solvents, aldehydes, and related chemicals may also affect the vaginal microenvironment and potentially disrupt protective *Lactobacillus* populations. Reduced lactobacilli may favor the growth of anaerobic bacteria, including *Gardnerella vaginalis* and *Prevotella* species, potentially increasing susceptibility to bacterial vaginosis (Upson et al., 2022; Park et al., 2019). However, direct evidence linking scented sanitary pads to vaginal microbiome disruption remains limited. Certain fragrance formulations may contain phthalates and synthetic musks with potential endocrine-disrupting properties. These compounds can interfere with hormonal signaling, although evidence regarding their specific effects from sanitary-pad exposure remains insufficient (Upson et al., 2022; Marroquin et al., 2024). Epidemiological studies have reported associations between phthalate exposure and reproductive outcomes such as reduced fertility and altered ovarian function, but causality and exposure-specific effects require further investigation (Buck Louis et al., 2016). Repeated exposure to fragranced products may also contribute to chronic vulvar irritation and allergic skin conditions, potentially affecting quality of life (Fischer, 2020).

Gynecological and Reproductive Health Effects:
Growing evidence suggests that prolonged exposure to fragranced menstrual products may affect gynecological and reproductive health through several pathways. Direct contact with the vulvovaginal epithelium may contribute to irritation, allergic contact dermatitis, vulvitis, pruritus, and burning, particularly following repeated exposure to oxidized fragrance allergens such as limonene and linalool (Eason & Feldman, 1996; Marroquin et al., 2024). Fragrance chemicals may alter the vaginal microenvironment and potentially upset protective *Lactobacillus* populations (Upson et al., 2022).

Phthalates, synthetic musks, parabens, and other fragrance-related chemicals have raised concerns about endocrine and reproductive effects. Phthalate exposure has been associated with altered ovarian function, reduced fertility, and other reproductive outcomes (Buck Louis et al., 2016; Marroquin et al., 2024). A systematic review also identified phthalates, VOCs, fragrance chemicals, parabens, phenols, and dioxins in menstrual products, highlighting their potential as exposure sources.

Possible associations have also been reported between chemical exposure and conditions such as chronic vulvar irritation, vulvodynia, urinary tract infections, and pelvic inflammatory disease (Bornstein et al., 2019; Foxman, 2014; Wiesenfeld & Sweet, 2015; Fischer, 2020). However, direct epidemiological evidence linking scented sanitary pad use to these conditions remains limited.

Public Health Implications of Scented Sanitary Pad Use in Bangladesh:
Scented sanitary pads may pose public health concerns due to repeated exposure to phthalates, VOCs, fragrance chemicals, parabens, phenols, and dioxins throughout the reproductive years (Marroquin et al., 2024). In Bangladesh, menstrual stigma, incomplete health literacy, inadequate ingredient disclosure, and regulatory gaps may increase potential risks (Share-Net Bangladesh, 2025). Stigma and limited healthcare access may also delay care for symptoms such as irritation, itching, burning, abnormal discharge, and recurrent infections (Hennegan et al., 2019). Potential health effects of repeated exposure to allergenic and potentially

endocrine-disrupting chemicals warrant further study (Upson et al., 2022; Marroquin et al., 2024).

Certain VOCs may contribute to respiratory effects with prolonged inhalation, while long-term low-level dioxin exposure has been associated with cancer and other chronic health effects. Although rare, Toxic Shock Syndrome (TSS) can occur with menstrual product use. The CDC estimates approximately 1 in 100,000 menstruating women are affected annually (CDC, 1990).

From public health perspective, mandatory ingredient disclosure, stronger care monitoring, menstrual health education, and access to fragrance-free alternatives could help lessen unnecessary chemical exposure. Longitudinal, biomonitoring, and exposure-assessment studies are needed to clarify exposure levels and potential long-term health risks in women.

Relevance to Sustainable Development Goals (SDGs):

SDG 3	Women's reproductive health, prevention of chemical exposure, menstrual health, disease prevention
SDG 5	Menstrual dignity, women's rights, reducing menstrual stigma, empowering girls and women
SDG 6	Menstrual hygiene management and safe hygiene products
SDG 12	Chemical safety, ingredient disclosure, sustainable product regulation
SDG 16	Consumer protection, regulatory governance, product safety legislation.

Regulatory Challenges and Policy Implications:

Bangladesh has limited regulatory requirements for ingredient disclosure and chemical safety in menstrual hygiene products, with fragrance chemicals, VOCs, and potential allergens not routinely disclosed on product labels, thereby limiting informed consumer choice (BBS, 2022). Routine testing for heavy metals, fragrance allergens, VOCs, and endocrine-disrupting chemicals also appears limited (Park et al., 2019). Limited menstrual health education may further reinforce misconceptions about menstrual odor and product safety, while marketing may promote fragranced pads as more hygienic (Marroquin et al., 2024). Strengthening mandatory ingredient disclosure, standardized safety testing, chemical surveillance, and evidence-based menstrual health education could improve consumer protection and promote safer menstrual hygiene practices in Bangladesh.

Research Gaps:

Despite growing concerns about chemical exposure from fragranced menstrual products, evidence on vulvovaginal absorption, cumulative exposure, and long-term health effects remains limited. Future research should prioritize longitudinal epidemiological, biomonitoring, and toxicokinetic studies to assess gynecological, reproductive, endocrine, and systemic outcomes and quantify internal exposure. Standardized testing protocols are also needed to evaluate fragrance chemicals, VOCs, phthalates, heavy metals, and other potential contaminants.

In Bangladesh, research should further assess consumer awareness, menstrual health literacy, product-use behaviors, regulatory compliance, and population exposure. Such evidence could support risk-informed regulation, improve ingredient transparency, and strengthen menstrual health programs and consumer protection.

Conclusion:

In Bangladesh, scented sanitary pads show a complex intersection of socio-cultural practices, chemical exposure, commercial advertising, and regulatory limitations with probable implications for women's health. Fragrance formulations contain various mixtures of volatile and semi-volatile compounds with varying toxicological profiles (Park et al., 2019). Some of these chemicals have been associated with skin irritation, allergic sensitization, vaginal microbiome disruption, endocrine activity, systemic absorption following repetitive exposure (Upson et al., 2022). Given their persistent use in the reproductive lifespan, scented sanitary pads signify a chronic source of chemical exposure. Their widespread use is influenced by menstrual stigma and cultural outlooks surrounding menstrual odor, despite the absence of recognized hygienic benefits (Share-Net Bangladesh, 2025). Limited regulatory oversight and the absence of mandatory ingredient expose further restrict informed consumer decision-making (BBS, 2022). Addressing these challenges requires evidence-based menstrual health education, better access to fragrance-free products, and the promotion of safer alternatives, including unscented products, organic cotton pads, and reusable or eco-friendly menstrual products (e.g., made from bamboo pulp or other biodegradable materials), where appropriate (Marroquin et al., 2024). Strengthening rules and regulation through mandatory

ingredient disclosure, allergen labeling, VOCs safety assessment, and controls on hazardous fragrance chemicals could improve consumer safety (Upson et al., 2022). Besides, improper disposal can contribute to microplastic release and potential health risks from toxic substances leakage into soil and water (Harishchandre & Joshi, 2024). Additional scientific studies are required to clarify health effects and support evidence-based regulatory and public health policies.

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Appendices:

A) Health Hazards of Chemicals Commonly Used in Scented Sanitary Pads:

Chemicals	Health hazards
Fragrances (Synthetic perfumes)	Skin irritation, allergic reactions, vulvar irritation, infections, hormone disruption, trigger migraine and asthma, etc.
Phthalates (Fragrance carrier)	Skin irritation, contact dermatitis, Endocrine disruption, reproductive disorders, child growth & developmental problems, early puberty, potential cancer risks, etc.
Formaldehyde (Preservative)	Skin irritation, potential cancer risks, etc.
Parabens (Preservatives)	Skin irritation, contact dermatitis, mimic estrogen, potential cancer risks, etc.
Triclosan (Broad-spectrum antimicrobial, preservative)	Endocrine disruption, thyroid hormone interference, antibiotic resistance, allergic reactions, etc.
Chlorine and Dioxins (Bleaching byproduct)	Cancer risks, immune dysfunction, endocrine disruptors, endometriosis, birth defects, reproductive disorders, etc.
Volatile organic compounds (Toluene, Xylene, etc.)	Headaches, dizziness, respiratory issues, skin irritation, potential damage to the liver and kidneys, etc.

B) Health Hazards of Fragrance Commonly Used in Scented Sanitary Pads:

Fragrance Category	Common Examples	Typical Chemicals	Potential Health Effects	Key References
Floral	Rose, Jasmine, Lavender, Orchid, Lotus, Hibiscus	Linalool, Benzyl alcohol, Limonene, Geraniol, Benzyl salicylate	Allergic contact dermatitis, vulvar irritation, erythema, pruritus, burning sensation, sensitization following oxidation, etc.	Eason & Feldman, 1996; Upson et al., 2022; Marroquin et al., 2024
Fruity	Lemon, Orange, Mango, Pineapple, Strawberry, Peach, Apple, Banana	Citral, Limonene, Aldehydes, Esters, Benzyl acetate	Mucosal irritation, allergic reactions, skin sensitization, microbiome disturbance after repeated exposure, etc.	
Herbal	Aloe Vera, Neem, Tulsi, Rosemary, Eucalyptus, Sage, Sandalwood	Essential oils, Terpenes, Phenolic compounds	Irritation in sensitive individuals, altered vaginal pH, disruption of *Lactobacillus* populations, allergic dermatitis, etc.	
Fresh/ Clean	Cotton Fresh, Clean Linen, Fresh Breeze, Fresh Air	Synthetic musks, Aldehydes, VOCs, DEP	Chronic chemical exposure, skin irritation, possible endocrine-disrupting effects, fragrance allergy	
Ocean/ Marine	Ocean Breeze, Marine Fresh, Aqua Fresh	Galaxolide, Tonalide, Synthetic musks	Potential bioaccumulation, weak estrogenic activity, endocrine disruption, allergic reactions, etc.	
Powdery	Baby Powder, Powder Fresh, Soft Powder	Coumarin, Synthetic musks, Benzyl salicylate	Contact dermatitis, allergic sensitization, prolonged fragrance exposure, etc.	
Cool/ Menthol	Cool Menthol, Ice Mint, Arctic Cool	Menthol, Synthetic cooling agents, Eucalyptol	Burning sensation, irritation of sensitive vulvar tissue, allergic reactions, etc.	
Musk-Based	White Musk, Soft Musk, Velvet Musk	Galaxolide, Tonalide, Musk ketone	Bioaccumulation in adipose tissue, endocrine activity, long-term exposure concerns, etc.	