

Profile of Non Compliant Cosmetic Findings Based on Sampling and Testing Results by the Jakarta National Agency of Drug and Food Control (BBPOM) (2022–2024 Period)

Aprilia Ratna Susanti^{1*}, Kartika Sari², Ajeng Illastria Rosalina³

Institut Tarumanagara, Indonesia^{1,2}

Balai besar pengawas obat dan makanan, Indonesia³

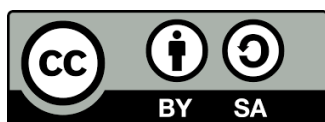
Email: apriliasanti971@gmail.com^{1*}, kartikasari.apt22@gmail.com²,
ajengrosalyne.air@gmail.com³

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Abstract

The projected growth of the global personal care market to US\$108.97 billion by 2024, combined with the fact that 90% of individuals use cosmetics daily, corresponds with a 5.52% increase in e-commerce cosmetic sales in Jakarta during the third quarter of 2024. This rapid market expansion presents regulatory challenges for BBPOM Jakarta (Jakarta National Agency of Drug and Food Control) in ensuring the safety and compliance of cosmetic products. This study aimed to analyze trends in hazardous ingredients and identify changes in the categories of non-compliant (Tidak Memenuhi Syarat [TMS]) cosmetic products identified by BBPOM Jakarta during the 2022–2024 period. A quantitative descriptive approach was employed using an observational study design based on secondary data analysis from BBPOM Jakarta's annual reports. The findings revealed dynamic and increasingly complex trends in cosmetic safety violations. In 2022, violations were dominated by the use of potent topical pharmaceutical substances, including hydroquinone, retinoic acid, dexamethasone, and mometasone. However, during 2023–2024, violations expanded to include methanol contamination and the use of industrial dyes such as Red K-3. Simultaneously, the dominant product categories shifted from face creams in 2022 to fragrances and decorative cosmetics in 2023–2024. The profile of cosmetic violations in Jakarta underwent a significant transition from the misuse of pharmaceutical active ingredients to contamination involving industrial solvents and prohibited dyes. These findings are expected to provide an evaluative basis for strengthening post-market surveillance and improving cosmetic safety monitoring strategies.



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INTRODUCTION

According to 2025 statistical data, the global personal care market was projected to reach US\$108.97 billion in 2024, with continued growth of US\$30.32 billion expected between 2024 and 2030 (Statista, 2025). Increased awareness of skincare and the rise of beauty trends on social media have contributed to 90% of individuals using cosmetics daily (Alnuqaydan, 2024). To ensure consumer safety amid this substantial growth, the government, through the National Agency of Drug and Food Control (BPOM), has established stringent regulatory standards, including updated requirements and stricter sanctions outlined in BPOM Regulation Number 25 of 2025 concerning Technical Requirements for Cosmetic Ingredients (Peraturan BPOM, 2025). This global market expansion is closely associated with economic trends in Jakarta, a metropolitan city and the nation's economic center (Huzaeroh et al., 2024). Data from the Bank Indonesia Representative Office for DKI Jakarta (2024) indicate that cosmetics were

among the categories contributing to increased e-commerce sales in Jakarta during the third quarter of 2024, with year-on-year (yoy) growth of 5.52%, increasing from the previous 4.27% yoy. However, rapid developments in the digital market have also created opportunities for the circulation of illegal cosmetics produced without compliance with Good Manufacturing Practices for Cosmetics (Cara Pembuatan Kosmetik yang Baik [CPKB]). Furthermore, failure to comply with ingredient requirements in cosmetic formulations may alter the safety profile of products distributed to consumers (Ariyanti, 2024). Consequently, BBPOM Jakarta faces significant challenges in ensuring the safety and compliance of cosmetic products (Chrestella et al., 2025). In response to these challenges, BBPOM Jakarta implements comprehensive supervision strategies covering both pre-market and post-market phases through routine and non-routine sampling schemes (BBPOM, 2024). Through this approach, BBPOM serves as a regulatory authority responsible for ensuring the safety of cosmetic products circulating in the market (Suyudi et al., 2022). National supervision is conducted through an integrated and standardized system, including facility inspections and sample collection for laboratory testing (Nursyhadah, 2023). These laboratory tests serve as the primary mechanism for classifying cosmetic products as meeting requirements (Memenuhi Syarat [MS]) or not meeting requirements (Tidak Memenuhi Syarat [TMS]) according to applicable regulations (BBPOM, 2024) (Naqvi et al., 2022).

The classification of cosmetic products as TMS or MS is determined through laboratory testing involving chemical analysis across various parameters (BBPOM, 2024). Microbiological contamination testing is not conducted on every cosmetic sample but is performed based on risk assessment to identify products with potential non-compliance (BBPOM, 2024). Microbial contamination resulting from manufacturing processes that do not comply with Good Manufacturing Practices for Cosmetics (Cara Pembuatan Kosmetik yang Baik [CPKB]) may cause Total Plate Count (TPC) and Yeast and Mold Count (YMC) values to exceed established limits. This condition not only affects compliant local manufacturers but also poses potential risks to consumer health (Ditwaskos, 2024).

One factor contributing to toxicity risks in TMS cosmetics is the presence of hazardous or prohibited ingredients in formulations. Examples include retinoic acid, which is classified as a prohibited substance due to its potential to cause severe irritation and teratogenic effects (BBPOM, 2022). Hydroquinone has also been detected in non-compliant cosmetic products; this substance may cause skin irritation (Alshammari et al., 2025), increased sensitivity, and exogenous ochronosis when used without appropriate medical supervision (Handayani et al., 2025). Similarly, methanol, which is sometimes misused as a solvent, may cause toxic effects ranging from central nervous system depression to severe metabolic acidosis (Nisbar et al., 2023).

The toxic effects of cosmetic products are influenced not only by the presence of hazardous active substances but also by formulation characteristics and delivery systems (Niken et al., 2025). From a biopharmaceutical perspective, the formulation base influences the duration of skin exposure and the absorption characteristics of active substances (Adha et al., 2025). For example, cream formulations may affect the retention of substances on the skin surface and their penetration into target tissues, including melanocytes (Utami & Amelia,

2025). Consequently, prolonged exposure to hazardous substances may contribute to progressive disruption of the skin barrier (Thaçi et al., 2025).

The increasing toxicity risks and changing patterns of cosmetic circulation in Jakarta highlight the need for an in-depth analysis of trends in non-compliant (Tidak Memenuhi Syarat [TMS]) cosmetics identified during the 2022–2024 period. Although data are available in BBPOM Jakarta annual reports, these data remain primarily administrative and have not been systematically analyzed to identify broader patterns. This study differs from Nursyhadah (2023), which focused on illegal cosmetic supervision within a specific period, and Kashuri et al. (2025), which emphasized general regulatory aspects of cosmetics in Indonesia. Therefore, this research aimed to identify trends in hazardous ingredients and map changes in product categories among non-compliant cosmetics in Jakarta during 2022–2024. The urgency of this study lies in analyzing the evolving pattern of violations, ranging from the misuse of pharmaceutical active ingredients to contamination involving industrial solvents and prohibited colorants. Consequently, the findings provide an evaluative database to support policymakers in optimizing cosmetic safety surveillance (Alrashed et al., 2024).

The novelty of this study lies in its comprehensive analysis of the changing profile of non-compliant cosmetics in Jakarta over a three-year period (2022–2024). Unlike previous studies that focused on specific periods or general regulatory aspects, this study provides a dynamic overview of trends in hazardous substances and changes in product categories. The analysis identifies a transition from the misuse of pharmaceutical active ingredients, such as hydroquinone, dexamethasone, and retinoids, to contamination involving industrial solvents, such as methanol, and prohibited dyes, such as Red K-3. This transition highlights the need for adaptive surveillance strategies to address evolving patterns of cosmetic violations (Aprilia et al., 2022; Astuti et al., 2026; Bamidele et al., 2023; Sudarma et al., 2025). The study also integrates toxicological risk considerations with regulatory findings to provide a more comprehensive understanding of cosmetic safety issues. Furthermore, systematic data extraction and analysis procedures were applied to strengthen the validity and reliability of the findings (Amitava & Khan, 2025). Through this approach, the study contributes to the development of more effective and responsive cosmetic safety surveillance strategies in Indonesia.

This study aimed to analyze trends in hazardous ingredients and identify shifts in product categories among non-compliant (Tidak Memenuhi Syarat [TMS]) cosmetics recorded by BBPOM Jakarta during the 2022–2024 period.

METHOD

Conceptual Framework

The conceptual framework of this study outlined the flow of secondary data analysis on cosmetic products supervised by BBPOM Jakarta (Jakarta National Agency of Drug and Food Control). The analysis process involved reviewing annual supervision reports from 2022–2024, followed by data extraction, screening, and analysis of trends in hazardous substances and changes in categories of non-compliant cosmetic products.

Location and Time of the Study

This study was conducted at the National Agency of Drug and Food Control (BPOM) in Jakarta, located at Jl. Assyafi'iyah No. 133, Cilangkap, Cipayung, East Jakarta, Special Capital Region of Jakarta 13870. The study was carried out from March 2026 to June 2026.

Type and Design of the Study

This study used a quantitative descriptive approach, a method used to describe, summarize, and systematically present numerical data in order to provide an objective picture of a phenomenon (Soesana et al., 2023). This approach was chosen to present the trends and shifts in findings of non-compliant (TMS) cosmetic products based on secondary data from sampling and testing by BPOM Jakarta. The study design was a descriptive observational study utilizing historical data, in which the researcher observed and recapitulated the research variables without any intervention or treatment of the subjects or data studied (Adiputra et al., 2021).

Operational Definitions

The operational definitions of the research variables, including the measurement instrument, measurement results, and scale for each variable, are presented in Table 1.

Table 1. Operational Definitions

Variable	Operational Definition	Instrument/Method	Measurement Result	Scale
Year of Supervision	Time period of cosmetic sampling and testing by BPOM Jakarta	Observation of secondary data from BPOM Jakarta annual reports	2022, 2023, 2024	Ordinal
Sampling Type	Product supervision pathway, consisting of routine and non-routine sampling	Review of sampling category column in the annual report	1. Routine 2. Non-routine	Nominal
Preparation Category	Classification of product type based on physical form according to BPOM classification	Observation sheet (checklist)	1. Semi-solid (cream, gel, ointment) 2. Liquid (solution, suspension, liquid emulsion) 3. Solid (powder, compact/solid, stick)	Nominal
Chemical Test Parameter	Type of hazardous chemical substance identified above the safe limit	Laboratory test report	Hydroquinone, retinoic acid, red dye K3, dexamethasone, mometasone, mercury, betamethasone, methanol	Nominal
Quality Status	Final conclusion of product eligibility based on safety standards (BPOM Regulation No. 16/2024 and No. 25/2025)	BPOM Regulation No. 16/2024 and No. 25/2025	0 = Compliant (MS) 1 = Non-compliant (TMS)	Nominal

Note: a Microbiological Test Parameter variable (measuring ALT and AKK contamination levels, nominal scale) was also included in the original operational definitions but is omitted here for brevity.

Research Variables

In this quantitative descriptive study, the researcher did not test cause-and-effect relationships between variables, but rather focused on the systematic visualization and description of data (Sihotang et al., 2023). The variables observed were characteristics of BBPOM Jakarta's secondary cosmetic-supervision data for the 2022–2024 period, comprising: sampling type (the method or pathway of cosmetic sample collection by supervisory officers); testing parameters (the type of laboratory testing performed on samples, covering chemical and microbiological parameters); cosmetic quality status (the final quality assessment result, classified as Compliant or Non-compliant); and cosmetic product preparation category (the type or classification of the cosmetics sampled).

Research Flow

Data collection was carried out systematically by tracing electronic documents on the official BBPOM Jakarta portal (jakarta.pom.go.id), navigating to the Public Information service, specifically the Periodic Information category, in order to identify and download the BBPOM Jakarta Annual Reports for 2022, 2023, and 2024. These documents served as the main source of secondary data, as they transparently record product supervision activity in the Jakarta area.

After the documents were obtained, a data extraction stage was carried out, focusing on the sections reporting the results of sampling and laboratory testing of cosmetic preparations; the data found were then filtered according to strict criteria to ensure validity. Inclusion criteria were set on the results of routine and non-routine supervision conducted independently by BBPOM Jakarta, including samples entering through the Early Warning System (EWS) scheme, while exclusion criteria removed data originating from third parties such as the Police, the Ministry of Health, and DitWasKos, to ensure that the results purely reflected BBPOM's own field supervision activity. Data meeting the criteria were then recapitulated into tables for the subsequent analysis stage.

Population and Sample

The population comprised all cosmetic testing data contained in the BBPOM Jakarta annual reports for the 2022–2024 period. The sample consisted of the routine and non-routine cosmetic testing/sampling records of BBPOM Jakarta, the corresponding chemical and microbiological test results, and the types of hazardous substances found in the cosmetic samples.

Inclusion criteria comprised laboratory test data on chemical and microbiological parameters that specified a Compliant/Non-compliant quality status and, for hazardous-substance findings, specified the preparation category, drawn from routine and non-routine supervision conducted independently by BBPOM Jakarta, including samples obtained through the Early Warning System (EWS). Exclusion criteria comprised post-market supervision activities other than sampling and testing (such as labeling supervision) and samples originating from units other than BBPOM Jakarta, such as the Police, the Ministry of Health, or DitWasKos.

Research Instrument

The tools used in this study were an Acer laptop with an Intel Core i5 processor, data management software (Microsoft Excel), a mobile phone, and stationery. The research materials consisted of the BBPOM Jakarta Annual Reports for 2022, 2023, and 2024.

Data Collection Process

Data collection applied an analytical observational method using secondary data sourced from the BBPOM Jakarta Annual Supervision Reports for 2022–2024. This stage began with obtaining administrative permits from the relevant institution through the submission of an official letter of introduction from the researcher's academic institution, aimed at securing legal access to and transparency of the required sampling and laboratory testing data.

Once official permission was obtained, the next stage involved data extraction, sorting, and recording all crucial information contained in the Annual Reports, specifically the results of routine and non-routine sample testing, the cosmetic profile based on chemical and microbiological test parameters, and the identification of hazardous or prohibited substances detected in the samples. This recapitulation was carried out comprehensively to map trend patterns and analyze the correlation between findings and compliance status (Compliant/Non-compliant). The collected data then underwent a screening process to ensure that all samples met the established inclusion criteria, before being systematically organized using data-processing software to facilitate visualization, minimize input error, and support further descriptive analysis.

Data Analysis

After data collection, the data were processed through editing and data entry using the software, and then analyzed using two methods. Trend analysis of hazardous substances was applied to describe changes in the number of findings of each hazardous or prohibited substance detected in non-compliant (TMS) cosmetic samples over the 2022–2024 period; the total findings were presented in a recapitulation table and transformed into a grouped bar chart to clearly map the increase or decrease in findings of each hazardous substance across observation periods.

The second method, analysis of shifts in cosmetic preparation category, was used specifically to examine the characteristics of non-compliant (TMS) cosmetic samples by preparation category over the 2022–2024 period; the total figures were presented in a recapitulation table and visualized as a series of pie charts presented separately for each year, in order to illustrate each category's contribution and identify any shift in the dominant preparation category associated with violations each year.

RESULTS AND DISCUSSION

Supervision by BBPOM Jakarta, 2022–2024

Cosmetic products were supervised through two methods: routine supervision, a planned, continuous activity with targets set at the start of each month or year to ensure business compliance and product quality (BBPOM, 2022), and non-routine supervision via the Early Warning System (EWS), triggered by strong suspicion of violations and used as an early-detection mechanism (BBPOM, 2022). Routine supervision itself comprised targeted sampling (focused on products with a poor track record, specific countries of origin, or suspected

prohibited ingredients) and random sampling (a broader compliance check across both offline retail and online/e-commerce channels) (BBPOM, 2024). All samples subsequently underwent chemical testing for hazardous/prohibited substances and microbiological testing (Total Plate Count, Yeast/Mould Count, and pathogenic bacteria) to verify compliance with Good Cosmetic Manufacturing Practice (BBPOM, 2022; PerBPOM, 2026). Supervision results for 2022–2024 are summarized in Table 1.

Table 2. Supervision Results, 2022, 2023, and 2024

Year	Supervision Source / Method	Total Samples	Compliant (N)	Non-compliant N (%)
2022	Routine – Targeted	288	288	0 (0.0%)
	Routine – Random	672	670	2 (0.2%)
	Routine Total	960	958	2 (0.2%)
	Non-routine (EWS)	62	35	27 (43.5%)
2023	Routine – Targeted	275	275	0 (0.0%)
	Routine – Random	644	643	1 (0.1%)
	Routine Total	919	918	1 (0.1%)
	Non-routine (EWS)	17	14	3 (17.6%)
2024	Routine – Targeted	290	286	4 (1.3%)
	Routine – Random	674	674	0 (0.0%)
	Routine Total	964	960	4 (0.4%)
	Non-routine (EWS)	66	49	17 (25.8%)

Across the three years, routine sampling consistently showed a much lower non-compliance (TMS) rate than non-routine EWS sampling, reflecting a fundamental difference in targeting strategy: routine sampling is largely preventive and administrative, based on general market risk profiles, whereas EWS sampling is triggered by intelligence data, crime-risk indicators, and initial enforcement investigation — including digital-footprint tracing and cyber patrol — so that samples entering the laboratory through this route are almost certainly problematic (BBPOM, 2024). TMS findings in routine supervision came from random sampling in 2022 and 2023, and from targeted sampling in 2024, while EWS consistently produced substantial TMS findings each year, peaking in 2022. Detailed findings on the specific hazardous substances involved are presented in Table 2.

Hazardous Substance Data, 2022–2024

Table 3. Hazardous Substances Found, 2022, 2023, and 2024

No.	Hazardous Substance	2022	2023	2024
1	Thioglycolic acid (mercaptoacetate)	2	0	0
2	Methanol	0	1	5
3	Hydroquinone	21	2	7
4	Retinoic acid	17	3	6
5	Colorant (K3 / Rhodamine B)	0	0	4
6	Mercury	5	0	4

No.	Hazardous Substance	2022	2023	2024
7	Dexamethasone	1	0	0
8	Mometasone	1	0	0
Total		47	6	26

A clear shift in the type and volume of hazardous substances was observed. In 2022, routine sampling found only thioglycolic acid, while hydroquinone, retinoic acid, mercury, dexamethasone, and mometasone were all detected through EWS (BBPOM, 2022). In 2023, methanol newly emerged in routine inspection while thioglycolic acid was no longer found, and EWS identified hydroquinone and retinoic acid (BBPOM, 2023). By 2024, risk complexity increased with five substance variants found: hydroquinone remained dominant, followed by retinoic acid and methanol (now via routine supervision), alongside new mercury and K3 dye (MK3) findings (BBPOM, 2024). The emergence of MK3 in imported products underscores the need to strengthen import-entry controls alongside domestic market sampling (Putri & Setianingrum, 2025).

Across the three-year period, hydroquinone, retinoic acid, and mercury were the dominant contaminants, driven by sustained consumer demand for instant skin-lightening results and susceptibility to aggressive marketing (Danimayostu et al., 2025; Pratiwi & Listiana, 2025). This mirrors global patterns: Portugal's INFARMED authority (2018–2023) similarly documented significant non-compliance including carcinogenic/mutagenic/reprotoxic (CMR) substances, compounded by an estimated under-reporting rate exceeding 90% (Vieira et al., 2024) — a reminder that a decline in findings, such as Jakarta's 2023 figures, cannot automatically be read as improved compliance without considering sampling-reach limitations. The renewed rise in 2024 echoes regional findings in Malaysia, where self-regulation through notification and post-market surveillance has proven vulnerable to abuse, with illegal products similarly containing mercury, hydroquinone, tretinoin, and corticosteroids (Othman et al., 2024), reinforcing the need for BBPOM Jakarta to keep tightening standards and sanctions (Anggraini, 2024).

Regulatory Status and Risk Profile of Key Hazardous Substances

Under BPOM Regulation No. 25 of 2025 on Technical Requirements for Cosmetic Ingredients (PerBPOM, 2025), each substance found carries a distinct regulatory status and toxicological rationale. Thioglycolic acid (mercaptoacetate) is an Annex-I ingredient permitted only within strict concentration and pH limits (up to 8% for self-application, 11% for professional use, 5% for depilatories, 2% for rinse-off hair products), reflecting its mechanism of penetrating the hair cortex and reductively cleaving disulfide bonds; misuse above these limits can cause hair breakage, protein loss, and scarring or areata alopecia (Barreto et al., 2021; Di Foggia et al., 2024; Ghanem et al., 2025; Sato et al., 2025).

Hydroquinone, retinoic acid (tretinoin), dexamethasone, and mometasone are listed in Annex V as prohibited cosmetic ingredients (hydroquinone has a narrow permitted exception only in artificial-nail products, at $\leq 0.02\%$ and professional application). These are frequently combined — hydroquinone with dexamethasone and retinoic acid forms the medically controlled "triple combination" (Kligman) formula, illegally repurposed into unsupervised skin-lightening creams (Adebusoye & Srivastava, 2025). Hydroquinone inhibits tyrosinase to

rapidly reduce melanin, but long-term use risks irritation and exogenous ochronosis (Adebusoye & Srivastava, 2025). Dexamethasone and mometasone are prohibited glucocorticoid steroids restricted to clinical use; misuse can cause skin cancer risk, withdrawal symptoms, hyperthyroidism, topical steroid damaged/dependent face (TSDF), and acneiform eruptions (Al Dhafiri et al., 2022). Retinoic acid accelerates keratinocyte turnover and is often combined to enhance penetration of other actives, but uncontrolled use causes dryness, erythema, desquamation, and photosensitivity (Mambwe et al., 2025; Milosheska & Roškar, 2022).

Mercury and its derivatives are Annex-V prohibited substances that inactivate melanin-forming enzymes; illegal use exploits its antibacterial and lightening properties, but dermal absorption can accumulate systemically and cause rashes, uneven pigmentation, and progressive systemic toxicity, with risk increasing when the skin barrier is compromised (Bastiansz et al., 2022; Cadungog et al., 2025; Jiang, 2024). Methanol is an Annex-I substance permitted only as a denaturant for ethanol/isopropyl alcohol (max 5%); in illegal fragrance products it is misused as a cheap solvent substitute, metabolizing in the body to toxic formic acid, which inhibits mitochondrial function and has a strong affinity for the optic pathway, risking severe poisoning and vision loss especially via inhalation of vaporized product (Ermete Güler et al., 2026; Hidayah et al., 2024; Liberski et al., 2022; Nisbar et al., 2023). The colorant K3/MK3 (CI 15585) is an Annex-V prohibited dye intended for industrial use (printing ink, plastics, rubber) but misused in decorative cosmetics such as eyeshadow and lipstick, where it can induce oxidative stress and has documented genotoxic/mutagenic potential linked to skin cancer risk (Fikri & Firmansyah, 2023; Pratiwi et al., 2022, 2024b). BBPOM Jakarta also noted a shift in 2024 toward illegal actors formally registering notification numbers to create a false impression of legality (BBPOM, 2024)

Cosmetic Preparations Containing Hazardous Substances

Analyzing the shifting distribution of TMS findings across preparation categories is essential, since preparation form determines the laboratory analysis method, exposure toxicity profile, and risk-based supervision strategy (Astuti et al., 2026). The distribution for 2022–2024 is summarized in Table 3.

Table 4. Cosmetic Preparations Containing Hazardous Substances, 2022, 2023, and 2024

No.	Preparation Category	2022	2023	2024
1	Hair preparation (straightening cream)	2	0	0
2	Facial – liquid (essence, toner, serum)	2	1	4
3	Fragrance (perfume)	0	1	2
4	Facial – cream (night cream, compounded cream)	23	1	10
5	Decorative (eyeshadow, pressed powder)	0	0	4
6	Facial (gel, ointment)	2	1	0
Total		29	4	20

In 2022, TMS findings were dominated by facial creams (compounded and night creams), consistent with international evidence that the semi-physical stability of creams makes

them a preferred matrix for illegal formulators to blend in hazardous actives (Bamidele et al., 2023); a comparative Pakistani study likewise identified skin-lightening creams as the most critical category, with mercury levels averaging $1,463 \pm 35 \mu\text{g/g}$ (Akhtar et al., 2022). Routine 2022 supervision additionally flagged hair-straightening products for exceeding maximum thioglycolic-acid limits. In 2023, overall findings declined — tentatively suggesting improved compliance — but a new finding emerged in fragrance products via routine sampling (Alqurashi et al., 2023), while violations were spread evenly across categories, with facial-care products still accounting for the largest share. In 2024, findings rose sharply again, dominated by cream and liquid facial preparations, with the added complexity of new violations in decorative cosmetics (eyeshadow, lipstick) and branded facial liquids (essence, toner).

These shifts reflect distinct exposure-risk profiles by preparation form: leave-on creams (emulsion-based, oil-in-water or water-in-oil) allow prolonged skin contact and act as active-ingredient delivery vehicles (Borkar, 2025; Jin et al., 2022; Muloogi et al., 2021); serums offer higher active-ingredient concentration with superior percutaneous penetration (Yulianto et al., 2022); decorative products such as eyeshadow are applied to the thin, sensitive periocular skin, raising the stakes of colorant safety (Sullivan et al., 2023); and fragrances pose a distinct inhalation risk, as volatile compounds dispersed by spraying can react with ambient pollutants (e.g., NO_x) to form secondary irritants such as ozone and ultrafine particulates, with chronic exposure linked to airway inflammation and reduced lung function (Alblooshi, 2025).

Consumer Behavior and Market Regulatory Dynamics

TMS findings are also driven by consumer-side vulnerabilities: low product literacy, limited awareness of ingredient risks, and market/regulatory gaps exploited through marketing strategies (Elvira et al., 2021; Talitha, 2026; Yuniarto & Anggoro, 2021). Most users are unaware of the cumulative risk of daily multi-product chemical exposure, and ingredient labels are often too complex to interpret — in Libya, 99% of consumers reportedly do not read ingredient lists (Khan et al., 2021; Korbag et al., 2022). Despite easier information access in the digital era, consumers rarely verify product legality, and low literacy in some areas further widens the gap exploited by profit-driven illegal actors (Khan et al., 2021; Wirtu, 2024). Strengthening cyber patrol is therefore critical given the shift of sales toward e-commerce and social media (BBPOM, 2024; Nadia Syahrani, 2025).

Even where individual hazardous-substance concentrations seem low, daily and repeated use across large body areas — particularly the face, where the stratum corneum is thinner (7–10 cell layers versus 15–20 on the arm) — allows cumulative exposure to build up over time (Alnuqaydan, 2024; Barrionuevo-Gonzalez et al., 2021; Khan et al., 2021). Beyond chemical contamination, microbiological contamination (e.g., *Staphylococcus aureus* and *S. epidermidis*) also poses risks of contact dermatitis and product degradation, often stemming from non-sterile raw materials, unsterilized process water, suboptimal Good Cosmetic Manufacturing Practice, and inadequate preservation (Alshehrei, 2023). These risks are compounded by consumer preference for instant skin-lightening results, even though lower-melanin skin is physiologically more vulnerable to UV-related erythema, photoaging, and post-inflammatory melasma (Menichetti et al., 2024; Roessle & Kerscher, 2025; Tod et al., 2024).

Overall, the 2022–2024 BBPOM Jakarta supervision data confirm a serious and evolving threat from non-compliant cosmetics: violation patterns have expanded beyond the traditional

hydroquinone/dexamethasone/retinoid combinations in creams to include methanol contamination in fragrances and hazardous Red K-3 dye in decorative cosmetics, further complicated by illegal actors manipulating the notification system to appear legitimate. This increasingly complex violation landscape demands stronger, more comprehensive technical regulation, sharper laboratory analysis, and tighter preventive and repressive supervision to safeguard public health on an ongoing basis.

CONCLUSION

Based on the data processing and discussion of non-compliant (Tidak Memenuhi Syarat [TMS]) cosmetic findings from BBPOM DKI Jakarta sampling data during the 2022–2024 period, it can be concluded that the trend of hazardous substances detected in non-compliant cosmetics showed increasingly complex variations over time. In 2022, hazardous substances were dominated by potent topical pharmaceutical ingredients, including hydroquinone, dexamethasone, retinoids, and mometasone furoate. However, during 2023–2024, the findings expanded to include methanol contamination and the presence of the prohibited industrial dye Red K-3 (Pigment Red 53/CI 15585).

The dominant categories of cosmetic preparations associated with TMS findings also showed significant changes throughout the supervision period. In 2022, violations were primarily identified in emulsion-based facial skincare products, particularly night creams and compounded creams. Meanwhile, during 2023–2024, the dominant categories shifted toward fragrance products (perfume) and decorative cosmetics, including eyeshadow and lipstick.

BBPOM Jakarta is recommended to strengthen post-market surveillance through stricter and more adaptive strategies that respond to changing cosmetic market trends. The post-market verification system should also be improved to minimize opportunities for formulation manipulation and distribution of non-compliant products. Consumers are encouraged to be more selective and avoid cosmetic products that claim instant results at low prices, particularly those marketed through social media platforms. Consumers should also actively apply the “Cek KLIK” verification (Kemasan, Label, Izin Edar, dan Kedaluwarsa) through official BPOM platforms before purchasing cosmetic products. Future research is recommended to extend the observation period, evaluate the implementation effectiveness of BPOM Regulation No. 25 of 2025, and explore the development of faster and more sensitive laboratory methods for detecting emerging cosmetic contaminants.

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