

Pakistan's Minamata Initial Assessment (MIA) Project Activities

MERCURY ADDED PRODUCTS

Mercury Poisoning Associated with International and Local Skin Whitening Creams in Pakistan



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Foreword

Present study is conducted to achieve the 3rd component of MIA (Minamata Initial Assessment in Pakistan) project by the joint effort of Ministry of Climate Change (MOCC) and Sustainable Development Policy Institute (SDPI) Islamabad. The objective of this study was to categorize the hazardousness of skin whitening creams (SWCs) by assessing *the* total mercury content in local and international brands of SWCs. The results showed that most of SWCs brands have the potential to cause mercury toxicity affecting both the skin and general public health.

The evidence based findings of our present research will most likely play a vital role to sensitize the policy-makers & relevant stakeholders on the fast increasing trend of hazardous SWCs use in the country. It would also help raise direly needed awareness of general public (especially female population) regarding the health problems due to the presence of 3rd most toxic substance “Mercury” in SWCs. So the relevant authorities can take control measures to safeguard public health, by developing mercury specific legislation to help regulate the use of mercury content in SWCs in the country at the earliest.

The study described and discussed in this report, is based on huge amount of work and research dedicatedly carried out by the mercury research team. Yet, implementation would not have been possible if we did not have the cooperation and support of many individuals and organizations. We would like to express our sincere gratitude to all of them. First of all, thanks to Ministry of Climate Change (MoCC), United Nations Environment and Sustainable Development Policy Institute (SDPI), for their financial and logistical support. We are highly indebted to Dr. Zaigham Abbas, MoCC for his guidance and constant supervision as well as for providing necessary and timely information regarding the project and also for his support in completing the research under MIA project.

We express our appreciation and thanks to Dr. Mahmood A. Khwaja, SDPI for sharing his pearls of wisdom with us and his valuable contributions, during the course of this research. We would like to express our sincere thanks towards all researchers who devoted their time and knowledge in accomplishing this study. We express our gratitude toward our families and colleagues for their kind co-operation and encouragement which help us in completion of this report well in time.

Executive Summary

Excessive use of Skin Whitening Creams (SWCs) has become a threat to human health and environment due to the presence of 3rd most toxic chemical “Mercury” as one of the ingredients. Toxicity of mercury and its transport (through air, water, aquatic species & birds) is well established and reported which stimulated the international world to curb this menace and resultantly, Minamata Convention on Mercury (MCM) emerged in 2013, to combat this hazard all over the world. MCM has been already ratified by over 100 countries. Pakistan being one of the signatories of MCM, has taken several initiatives, as responsible nation of the world.

To support, strengthen and enabling developing countries towards ratification of MCM, United Nations Environment under MCM has approved many MIA projects, including one on “Development of Minamata Initial Assessment (MIA) in Asia”, involving Cambodia, Pakistan and Philippines. Successful and rapid progress of MIA project implementation is the living example of Pakistan’s efforts to combat the resulting health impacts of mercury toxicity/exposure in the country, among others, by minimizing its use also in mercury added products. Research on skin whitening products carried out under component III of this project though the joint efforts of MoCC & SDPI.

This report covers all the details of research work, undertaken for accomplishing our study on local as well as international brands of SWCs collected from the markets at main cities of Pakistan. A total of 59 SWCs samples of different brands were collected, transported, stored, labeled, following all the requirements of standard procedures/protocol and finally handed over to officials of PINSTECH laboratories, Islamabad, Pakistan for total mercury content analysis, under a confidential identity number of each sample of purchased and studied brands of SWCs. Mercury analysis of 59 samples was found to be in the range of 0.74 ppm-44,292 ppm. The results showed that among 59 samples of SWCs studied only 3 samples contain mercury content below the MCM permissible (1ppm) limit.

Overall categorization of hazardousness of SWCs brand samples, based on the observed total mercury content in the studied samples and the resulting health risk due to mercury exposure, indicated that only 5% samples seem least hazardous (Hg content<1ppm), 56% moderately hazardous (Hg content<5000 ppm), 11 % highly hazardous (Hg content > 5000 ppm and 28 percent samples most hazardous (Hg >10,000 ppm). These results showed that maximum number of local as well as international SWCs, both have potential to create toxic exposure due to their mercury content, resulting in likely adverse health impacts to the consumers. If the use of these toxic mercury added SWCs products continues, it will deteriorate public health and the environment. Details of skin diseases and other illnesses caused by short and long term mercury exposures are briefly described in the foregoing pages of this report.

It is time to take immediate action and control measures, to curb the above alarming situation in the country. There is a dire need for a joint action by all relevant & responsible stakeholders, including government, to monitor and keep strict check and balance, on the manufacturers of local and imported SWCs brands. Development and implementation of standards, rules and

regulations, regarding excessive use of toxic chemicals (including mercury) in SWCs, would most likely create a visible & substantial change in controlling sub-standard hazardous SWCs production/import and their use across the country. The detail recommendations are described in Section 4 of this report which includes awareness raising among all SWCs consumers, about the toxic health effects of these products, the need for an effective and broad role of media, to change the misleading and exaggerated old age social concept about attractiveness, appeal and the beauty. Healthy skin is beauty NOT the complexion.

Acronyms

ASGM	Artisanal and Small- Scale Gold Mining
CFLs	Compact Fluorescent Lamps
DRAP	Drugs Regulatory Authority of Pakistan
EPAs	Environmental Protection Agencies
GB& AJK	Gilgit-Baltistan and Azad Jammu & Kashmir
GoP	Government of Pakistan
HGAAS	Hydride Generation Atomic Absorption Spectrometry
HEC	Higher Education Commission
Hg	Mercury
ICP-OES	Inductively Coupled Plasma Atomic or Optical Emission Spectroscopy
MCM	Minamata Convention on Mercury
MIA	Minamata Initial Assessment
MoCC	Ministry of Climate Change
MBBS	Bachelor of Medicine, Bachelor of Surgery
Ppm	Parts per million
PMDC	Pakistan Medical & Dental Council
PNAC	Pakistan National Accreditation Council
PINSTECH	Pakistan Institute of Nuclear Science and Technology
PSQCA	Pakistan Standards & Quality Control Authority
SDPI	Sustainable Development Policy Institute
SWCs	Skin Whitening Creams
UNEP	United Nations Environment Programme
UV	Ultra Violet
US	United States
FDA	Food and Drug Authority
WHO	World Health Organization

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Mercury Poisoning Associated with International and Local Skin Whitening Creams in Pakistan

1. Introduction

1.1. Minamata Convention on Mercury(MCM)

Minamata Convention on Mercury is an international treaty designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The roots of Minamata Convention found in Minamata tragedy. A Minamata disease was discovered in Minamata city in Kumamoto prefecture, Japan, in 1956. It was caused by the release of methyl mercury in the industrial wastewater from the Chisso Corporation's chemical factory, which continued from 1932 to 1968. This tragedy gave awareness to the world about taking steps to protect the human health and environment from the adverse effects of mercury. However, concrete efforts took place on the rise of 21st century. A mercury programme was established and further strengthened by governments in decisions of the Governing Council in 2005 and in 2007. Further an intergovernmental negotiating committee to prepare a global legally binding instrument on mercury was established, to commence its work in 2010. In January 2013, the intergovernmental negotiating committee concluded its fifth session by agreeing to the text of the Minamata Convention on Mercury. Major highlights of the Minamata Convention include a ban on new mercury mines, the phase-out of existing ones, the phase out and phase down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal once it becomes waste, sites contaminated by mercury as well as health issues. Minamata Convention on Mercury was adopted in October 2013 at Kumamoto, Japan and Pakistan signed the Convention on 10th October, 2013 at Kumamoto, Japan. Currently, 128 countries are the signatory and 101 countries have ratified the convention while Pakistan yet has to ratify it. After ratification, each party becomes obliged to phase out mercury in products by 2020 and in processes by 2025 (MCM, 2013).

1.2. Pakistan's Minamata Initial Assessment (MIA)

Pakistan being signatory of Minamata Convention is working hard to achieve the objectives of Convention. Successful implementation of Minamata Initial Assessment in Pakistan (MIA) project is the manifestation of this effort. Under article 19 of Minamata Convention, UNEP has approved a project titled "Development of Minamata Initial Assessment in Asia", involving Cambodia, Pakistan and Philippines. The main components of the Project are:-

- a. Establishment of coordination mechanism and organization of process

- b. Assessment of the national infrastructure and capacity for the management of mercury, including national legislation
- c. Development of a mercury inventory using the UNEP's mercury toolkit and strategies to identify and assess mercury contaminated sites
- d. Identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury
- e. Preparation, validation of National MIA report and implementation of awareness raising activities and dissemination of results
- f. Information exchange, capacity building and knowledge

Ministry of Climate Change, Government of Pakistan has taken several initiatives to achieve all these components. Unlike under component I, a national coordination mechanism has been designed for mercury management and ratification of the Convention. Moreover, a national inception workshop was also organized under this component. Similarly, to achieve component II, key national stakeholders and their roles were identified followed by the assessment of national infrastructure and capacity for mercury management. To accomplish component III, a detailed Hg inventory was conducted in all relevant sectors involved across all provinces of Pakistan through hiring national as well as international consultants. A national training workshop on mercury inventory using UNEP's toolkit was also organized under 3rd component. Similarly to attain component IV, challenges, needs, opportunities were assessed and recommendations were developed to implement the Minamata Convention on Mercury. Further, a national MIA dissemination and outreach strategy will be devised and the final MIA report will be developed under component V. Several trainings and awareness workshops on highlighting Hg issue have been organized in all provinces of Pakistan including GB and AJ&K under component VI of the project. Last but not the least, researches on mercury added products and processes in all over the Pakistan were conducted. Analysis of mercury in water and sediments samples from Artisanal and Small- scale Gold Mining (ASGM) sites at Gilgit-Baltistan were carried out. Researches on household products like batteries, CFLs and skin whitening products were conducted. Current report is also a manifestation of achievement of MIA project. It has compiled the research on national and international whitening creams in Pakistan, carried out by the joint efforts of MOCC and SDPI (Draft Report of MIA, 2018).

1.3. Background

White complexion is considered mark of beauty. To be more attractive, people take risk of using hazardous whitening products on their skin (Claudia et al., 2011). The production of whitening products is high across the globe. However, people of Middle East, South Asia, Africa and Latin America, are mostly involved in using skin whitening products due to higher melanin concentration in their skin. In past, consciousness about complexion was limited to women but now this perception also encourages men, to engage in skin bleaching. Similarly, Pakistani women want to keep their skin toned and beautiful by indulging in skin care products that bleach the skin. These whitening products contain hazardous substances for bleaching purposes i.e., hydroquinone, mercury, kojic acid and vitamin C, which can affect their health

(Amponsah et al., 2014). Due to harmful health effects of mercury, US FDA has set guideline of mercury in soaps and creams that its concentration must be less than 1ppm (FDA, 2000). In Pakistan higher demand of SWCs among all lower, middle and higher class induces manufacturing of these products at large level without any regulation of mercury content in them. Pakistan being a party of Minamata Convention will be responsible to phase out all SWCs which contain Hg content more than 1ppm till 2020. WHO report stated that in Pakistan, production of mercury containing skin whitening product is a common practice (WHO, 2013).

Mercury, a toxic metal contaminates to the environment through its natural as well as anthropogenic sources. Multiple anthropogenic sources have been reported to be a cause for spreading toxicity of mercury among environmental compartments and humans. Several well reported anthropogenic sources are mining, agriculture, and industry. However, mercury presence in cosmetics is among less explored routes of its exposure (Aranda et al., 2008). Use of whitening creams have been prevailing among people from different ethnic groups for centuries. Particularly, this trend got intensified in 1960, after discovery of whitening action of hydroquinone on the black skins of United States workers daily exposed to this agent in the rubber industry. From 1980s, a blooming interest in skin whitening cosmetics was observed. Nowadays, skin whitening is more often practiced for aesthetics reasons among American, Caribbean, African and Asian communities. A white skin tone is synonymous with youth and beauty while darker skin is considered symbol of lower social class (McDougall, 2016). McDougall (2013) stated that “the global market for skin lighteners is projected to reach US \$19.8 billion by 2018, driven by the growing desire for light-colored skin among both men and women primarily from the Asian, African and Middle East regions”. In Asian countries (India, Pakistan, China, Japan, and Korea) skin whitening products are particularly popular. This popularity is associated with social and aesthetic reasons. Hyperpigmentation in their skin encourages a wish to mimic westerners.

Mercury in whitening products acts as an inhibitor of melanin formation. Melanin is light absorbing pigment that is responsible for the human skin and hair coloration. It protects human being from the harmful UV rays of Sun (Desmedt et al., 2016). Mercury salts-mercuric chloride (II) and ammoniated mercury are mostly used in creams for whitening action on skin. It reduces melanin production by inhibiting the activity of tyrosinase enzyme. Mercury salts compete with copper in tyrosinase (Weldon et al., 2000). Skin whitening through these SWCs is a cause of mercury toxicity. Mercury salts easily penetrate into skin and accumulate in body due to their lipophilic property. Exposure to topical mercury salts lead to renal, neurological and dermal toxicity Cutaneous changes found like burning of the face, contact dermatitis, grey and blue-black facial discoloration, flushing, erythroderma, purpura, and gingivostomatitis (Soo et al., 2003). In addition, inorganic Hg salts are readily absorbed through the skin and excreted primarily via the kidneys, and elevated urinary Hg concentrations (>20 ug/L) have been associated with signs and symptoms of Hg poisoning (Engler, 2005). A study reported high level of mercury in blood and urine of 34 year old Chinese woman. This nephrotic syndrome was controlled after stopping the use of skin whitening cream (Tang et al., 2006). Similarly another study reported indicate a large proportion of nephrotic syndrome among African

women who were using ammoniated mercuric chloride-containing skin whitening creams (Barr et al., 1972).

Mercury in creams and other cosmetic products is eventually discharged into wastewater. The mercury then enters to the environment, where it becomes methylated and enters the food-chain as the highly toxic methylmercury in fish. Pregnant women who consume fish containing methylmercury transfer the mercury to their fetuses, which can later result in neurodevelopmental deficits in the children (Glahder et al., 1999).

Several studies in different countries reported presences of mercury in whitening products higher than 1ppm (permissible limit) guideline. Peregrino et al., 2011 study reported mercury level 878 to 35,824 ug/g in 6 Mexican whitening creams which exceeds US FDA guidelines. Due to high trend of using whitening products in Saudi Arabia, a study on 38 cream samples from local markets was conducted. In 28 samples, mercury level 0.09-5650 ug/g was found which is dangerous for health (Al-Saleh and Al-Doush 1997). In addition, Murphy et al (2009) studied 19 skin creams in Cambodia. Among these, in 9 samples mercury ranged from 19 to 12590 ug/g. However, Uremet al (2010), study on 67 skin whitening creams sold in Brazil, China, Kenya, Kyrgyzstan, India, Mexico, Russia and Senegal and produced both in these countries and also in France, UK, South Africa, Dubai, Mali, Ivory Coast and Switzerland, very low and safe levels of Hg (<0.07ug/g).

A few studies on SWCs use in Pakistan have also been reported. The use of SWCs to achieve fair complexion is considered to be effective tool, as agreed by majority of women (59%) in one study conducted in Pakistan, also agreeing that lighter skin tone is more beautiful and the use of skin lightening products are strongly associated with achieving fair complexion (Askari, 2013).

Chaudhry A, in 2014 analyzed 27 samples of SWCs and found the presence of mercury in all studied samples, in the range 0.42 to 78.92 ppm (Chaudhry 2014). Another study by Gul, in 2012 reported mercury in 9 out of 10 studied SWCs and mercury content in the range 8 to 63.2 ppm (Gul, 2012). Meanwhile, study of Khwaja and Ali (2017;2016), analyzed mercury in 20 samples of whitening creams and conducted interviews with dermatologists in order to find skin issues after using these creams. Results showed that mercury presences in these products turned the skin unhealthy and ugly.

1.4. Justification

Thousands of chemicals are used in material production processes that have not been adequately assessed for human and environmental impacts and yet are used daily in consumer products. There is ample scientific evidence to support a link between children's risks for neurodevelopmental disorders and toxic chemicals, such as mercury, in consumer products, food, air and water (Duruibe, Ogwuegbu, and Egwurugwu, 2007; Martin and Griswold, 2009). However, despite well-known hazards of mercury exposures, mercury contaminated skin whitening products are widely manufactured and available in pharmacies, and cosmetics shops of Pakistan like other regional states (Figure 1 below).



Figure 1: Different brands of SWCs in an open market

SWC products packages have little information and the ones with labels do not show presence of mercury in ingredients of these products. General public using these products is exposed to significant health risks. Already a study conducted by SDPI on mercury contaminated skin whitening creams samples from Karachi, Islamabad, Haripur, Peshawar and Lahore markets have been reported high level of mercury in most of skin whitening creams brands, exceeding the permissible limit of 1ppm (Khwaja and Ali 2017). The information that originates from the present study conducted in different cities of Pakistan on samples of local as well as international SWCs brands will be helpful, for raising awareness among skin specialists/dermatologists, policy-makers and the public as a whole regarding the mercury content in SWCs and the likely health impacts resulting from mercury exposure from high content mercury containing such products.

1.5. Objectives

Objective of present study is to analyze mercury level in the local as well as in international brands of skin whitening creams available in the local markets of a few selected cities of Pakistan and also share the data with policy makers/government officials, for their consideration, to develop and implement legislation towards a ban on the hazardous SWCs brands with mercury content higher than 1 ppm (article 4/Annex A MCM 2013).

2. Methodology

2.1. Sampling of Skin Whitening Creams (SWCs)

Skin whitening creams were collected from different cities i.e., Lahore, Islamabad, Karachi, Peshawar and Haripur etc. Markets of each lower, middle and elite - class were targeted. Available local and international brands from pharmacies and cosmetics shops of different cities were purchased. Preference for products selection was generally based on popularity of the brand. Mostly products which were labeled as whitening, lightening or fairness creams were selected for this study and preference was also given to products that were manufactured locally. A total of 59 creams were obtained. Among them Set A SWCs (Annex IA) was

collected by MOCC from May to June 2018 and Set B SWCs (Annex IB & Annex 2) by SDPI from December 2015-March 2016. All the product relevant information is mentioned in Annex IA & IB. None of the studied SWCs brands enlisted mercury as an ingredient on the package label or in the information leaflet inside the respective packages. All collected samples were given a confidential identity number which were saved along with the other relevant information provided on the package label or inside the package. SWCs samples with only confidential identity numbers were transferred to the PINSTECH laboratory, Islamabad, for the analysis of total mercury content on 26th June 2018. All necessary precautions were followed in the preparation and transport of the studied samples to the selected analytical laboratories. Results of all samples analyzed at PINSTECH analytical laboratory were reported/ received on 18th September, 2018.



Figure 2: Studied SWCs Brands Purchased From the Cities Open Markets

2.2. Experimental

All glassware were soaked overnight in 10% (v/v) nitric acid, followed by washing with 10% (v/v) hydrochloric acid, and rinsed with deionized distilled water and dried before using by laboratory analyst.

All the cream samples were first homogenized. Approximately 0.5g of each cream was weighed accurately into a 50mL volumetric digestion flask and 1ml of deionized water was added. A 5ml mixture of nitric acid and perchloric acid (1:1) was added and swirled. This was placed on the hot plate inside the fume cupboard until solution became cleared. On completion of digestion, the digested samples were allowed to cool to room temperature and made up to 50mL with distilled water.



Figure 3: Purchased SWCs Brands from the Open Markets and SWCs Prepared Samples Packages for Transport to Analytical Laboratory

It was then filtered using a whattman filter paper. Blank samples were also prepared using the same methodology without sample.

Samples were analyzed by two different techniques i.e., HGASS (RSD <5.0%) and ICP-OES (RSD < 2.0). The samples with lower mercury content were not detected by ICP-OES, so another technique HGASS was applied for mercury detection.

3. Results and Discussions

The results of all 59 SWCs samples studied are collectively given in Annex 3. As these were collected in two phases, from different markets and different time periods, these are reported and discussed in the foregoing pages as two sets A & B of SWCs samples.

Table 1 A: Results of Mercury Concentration (ppm) in Set A Skin Whitening Cream Samples

Sr No	Sample ID	Sample Color	Hg Content (ppm)
1	C001	White	5.02 (H)
2	C002	White	65 (I)
3	C003	Orange	19069 (I)
4	C004	Light Apple Green	10369 (I)
5	C005	Shocking Pink	15710 (I)
6	C006	Half White	2420 (I)
7	C007	Pink	2458 (I)

8	C008	Yellow	21 (I)
9	C009	Peach	9681 (I)
10	C0010	Light Brown	15973 (I)
11	C0011	White	18177 (I)
12	C0012	Light Green	4.39 (H)
13	C0013	White	1257 (I)
14	C0014	Light Yellow	8181 (I)
15	C0015	White	8.45 (H)
16	C0016	Half White	3923 (I)
17	C0017	Pink	2.59 (H)
18	C0018	Half White	15566 (I)
19	C0019	Light Brown	6035 (I)
20	C0020	Gray	14493 (I)
21	C0021	Half White	5129 (I)
22	C0022	White	16004 (I)
23	C0023	Brown	9.11 (H)
24	C0024	White	8.31 (H)
25	C0025	White	0.93 (H)
26	C0026	White	1.43 (H)
27	C0027	White	1.82 (H)
28	C0028	White	21.35 (H)
29	C0029	Light Peach	5.41 (H)
30	C0030	White	4.20 (H)
31	C0031	White	0.74 (H)

32	C0032	White	9.27 (H)
33	C0033	White	2.11 (H)
34	C0034	Light Brown	1.88 (H)
35	C0035	White	1.94 (H)

Techniques used for Mercury Analysis: (H) HGASS (I) ICP.OES

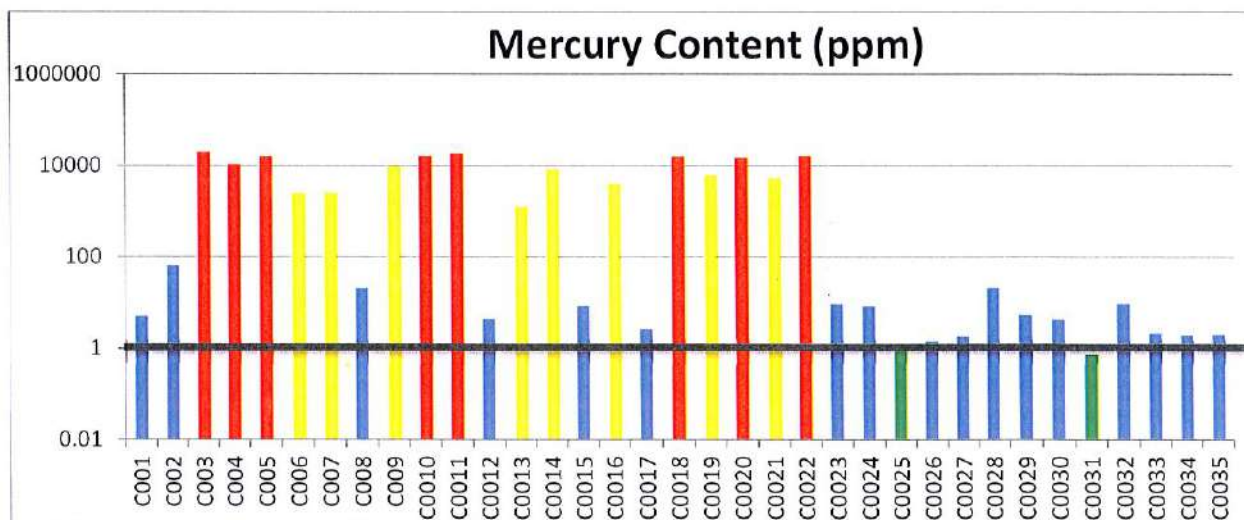


Figure 4: Mercury Content (ppm) in Set A SWCs

As evident from Table 1A & Table 1B and figure 4 & 5, only 3 SWCs samples C0031, IC-35 and C0025 were found to be below the permissible limit of 1 ppm. All the rest of the samples (95%) have total mercury content higher than the permissible limit (MCM, 2013). This is comparatively very high, compare to earlier study (Khwaja & Ali, 2017) in which 60% of studied SWCs samples had total mercury content > 1ppm. SWC samples C0031 and IC-36 have the lowest (0.74 ppm) and highest (44,292 ppm) total mercury content, respectively. In the earlier study, the lowest and highest total mercury content in the studied SWCs were found to be, 0.05 ppm and 26,500 ppm, respectively (-ibid- 2017).

Table 1 B: Results of Mercury Concentration (ppm) in Set B Skin Whitening Cream Samples

Sr No	Sample ID	Sample Color	Hg Content (ppm)
1	IC-34	Light pink	324.72(H)
2	IC-35	Shiny yellow	0.80 (H)
3	IC-36	White	44292 (I)

4	IC-38	Light pink	1.98 (H)
5	IC-39	Blue	23780 (I)
6	IC-40	White	21 (I)
7	IC-41	Green	7912 (I)
8	KC-37	Off-white	1479 (I)
9	KC-50	Green	16805 (I)
10	LC-21	Skin	13.49 (H)
11	LC-22	Light green	15795 (I)
12	LC-23	Off-white	7862 (I)
13	LC-24	Off-white	15.52 (H)
14	LC-25	Light pink	5.01 (H)
15	LC-26	Light green	40131 (I)
16	LC-27	Off-white	12044 (I)
17	LC-28	Yellowish white	19 (I)
18	LC-29	Pink	14895 (I)
19	P-42	Pink	1405 (I)
20	P-43	White	40 (I)
21	P-44	Yellow	18173 (I)
22	P-45	Off-white	36.29 (H)
23	X-46	Skin	128 (I)

24	X-47	Light purple	13658 (I)
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Techniques used for Mercury Analysis: (H) HGASS (I) ICP.OES

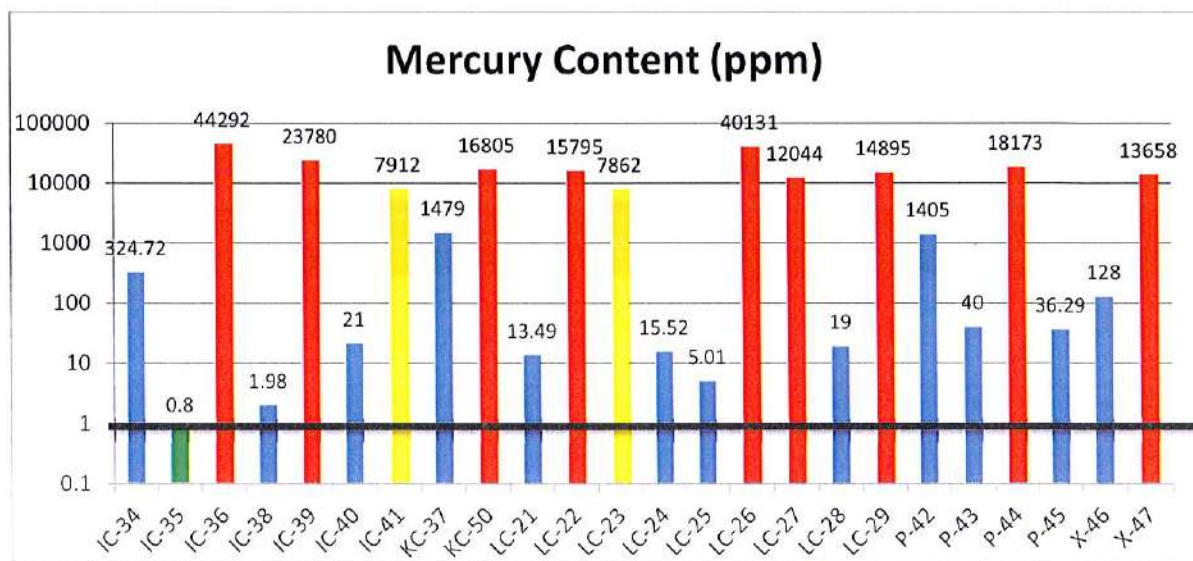


Figure 5: Mercury Content (ppm) in Set B SWCs

Tables 2 & 3 describe reported total mercury contents (range) of SWCs studies in non-Asian and Asian countries and their comparison with reported studies.

Table 2: Mercury Content of SWCs in Different Countries

SN	Reporting Country	No of SWC products studied	Mercury Content Range(ppm)
1	Mexico	16	< 0.01 –35824
2	UK	17	21.5-3.1% by weight
3	Norway	16	5.8–24000
4	Germany	2	2.56%-5.0% by weight
5	Denmark	2	39000–40000
6	The Netherlands	1	1% by weight
7	Austria	2	16400–38800
8	USA (New York)	8	62-41,600
9	Armenia, Belarus,	15	0.01 – 0.08860
10	Pakistan	112	,0.05 – 44, 292

Source: Khwaja, & Ali (2017; 2016)

At the lowest end of the Hg content range of SWCs samples in different non-Asian countries (Table 2), only two countries have Hg content less than the Pakistan SWC sample/s (0.05 ppm).

On the highest end of the mercury content range, Pakistan SWCs sample/s has the maximum value (44,292 ppm) among the reported countries (Table 2). Compare to Asian countries (Table 3), Sri Lanka and Philippines SWC sample/s have the lowest value (0.01 ppm) and the highest value (62,200 ppm), respectively. Among the 4 reported studies in Pakistan, Hg content of SWCs reported range between 0.05 – 44,292 ppm (Table 3). A comparison of total mercury content of Set A SWCs samples (Table 1 A) are in the range 0.74 ppm (sample ID C0031) and 19,069 ppm (sample ID C003) and the range for Set B SWCs samples (Table 1B) lies between 0.80 ppm (sample ID: IC 35) and 44,292 ppm (sample ID IC 36).

Table 3: Comparison of Mercury Content of SWCs in Pakistan with Some Other Asian countries

SN	Reporting Country	No. of products studied	Mercury Content Range (ppm)
1	Bangladesh	12	3,361-4,643
2	Saudi Arabia	38	0-5,650
3	Sri Lanka	39	< 0.01 -30,168
4	Nepal	7	0-0.52
5	Philippines	20	1054-62,200
6	Pakistan (PU 2012)	8	8 - 63
7	Pakistan (LCWU 2014)	25	0.42 - 79
8	Pakistan (SDPI study2017)	20	<0.05-26,500
9	Pakistan (Present study 2018)	59	0.74 – 44, 292

Source: Khwaja, & Ali (2017; 2016)

Khwaja and Ali (2017; 2016) categorization of SWCs based on the observed levels of total mercury contents in the studied SWCs samples and the health risk due to mercury exposure has also been used in the present study.

Table 4: Categorization of Studied Mercury Containing Hazardous SWCs

Level of Hazardousness			
Most Hazardous (17 SWCs)* (Hg >10000ppm)	Highly Hazardous (6 SWCs)* (Hg > 5000ppm)	Moderately Hazardous (34 SWCs)* (Hg < 5000ppm)	Least Hazardous (3 SWCs)* (Hg < 1ppm)
C003 (19,069)	C0021 (5,129)	C0034 (1.88)	C0025 (0.93)
C004 (10,369)	C0014 (8,181)	C0017 (2.59)	C0031 (0.74)
C005 (15,710)	C009 (9,681)	C0015 (8.45)	IC-35 (0.80)

C0010 (15,973)	IC-41 (7,912)	C0012 (4.39)	
C0011 (18,177)	LC-23 (7,862)	C001 (5.02)	
C0020 (14,493)	C0019 (6,035)	C0023 (9.11)	
C0022 (16,004)		C008 (21)	
C0018 (15,566)		C002 (65)	
IC-36 (44,292)		C0024 (8.31)	
IC-39 (23,780)		C0026 (1.43)	
KC-50 (16,805)		C0027 (1.82)	
LC-22 (15,795)		C0028 (21.35)	
LC-26 (40,131)		C0029 (5.41)	
LC-27 (12,044)		C0030 (4.20)	
LC-29 (14,895)		C0032 (9.27)	
P-44 (18,173)		C0033 (2.11)	
X-47 (13,658)		C0035 (1.94)	
		IC-34 (324.72)	
		IC-38 (1.98)	
		IC-40 (21)	
		KC-37 (1,479)	
		LC-21 (13.49)	
		LC-24 (15.52)	
		LC-25 (5.01)	
		LC-28 (19)	
		P-42 (1,405)	
		P-43 (40)	

		P-45 (36.29)	
		X-46 (128)	
		C0013 (1,257)	
		C0016 (3,923)	
		C006 (2,420)	
		C007 (2,458)	

*% SWCs

Our studied SWCs brands are categorized in four major groups (Table 4 & Figure 6 A) as most hazardous (Hg content > 10,000 ppm) highly hazardous (Hg content > 5000 ppm), moderately hazardous (Hg content < 5000 ppm) and least hazardous (Hg content < 1ppm). For comparison, earlier study categorization is described in Figure 6 B (Khwaja& Ali, 2017; 2016).

As evident from Table-4 & Figure-6 A, most of the studied SWCs brands (33) are moderately hazardous (Hg content < 5000 ppm), followed by most hazardous SWC (17), with mercury content > 10, 000 ppm. Six SWCs seem to be highly hazardous (Hg content > 5000 ppm) and only 3 studied samples least hazardous (Hg content < 1 ppm). A comparison of hazardous categories of the present and earlier studied SWCs samples (Figures 6 A & B), indicates a substantial decrease and increase in least hazardous (Hg < 1ppm) & highly hazardous (Hg > 5000 ppm) and moderately hazardous (Hg < 5000)SWCs brands, respectively. Proportionately, the most hazardous SWCs brands, with Hg content greater than 10,000 ppm remain about the same (Figure 6 A & B).

Figure 6 A (Present study)

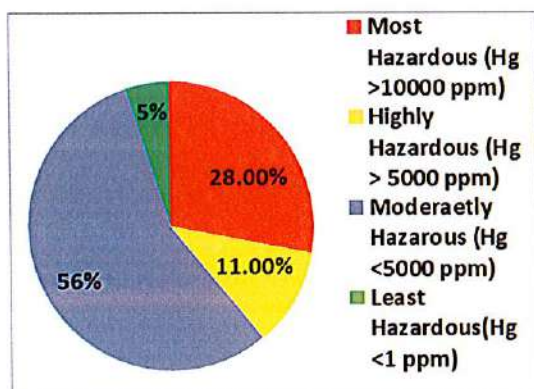


Figure 6 B (Earlier study)*

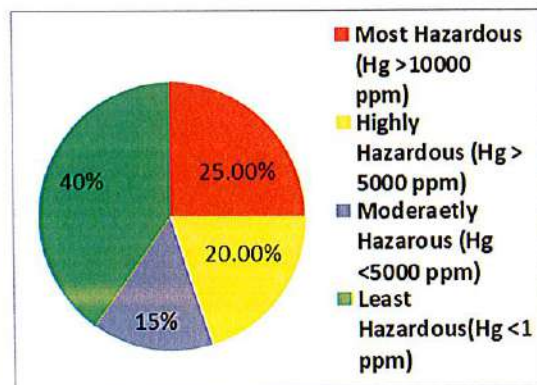


Figure 6 A & B: Mercury Containing SWCs Hazardousness Levels* (Khwaja & Ali, 2017; 2016)

4. Conclusion and Recommendations

According to a recently published report, products containing mercury may have serious side effects like neuronal damage, renal damage and anxiety/depression and decreased skin resistance to bacteria and fungi (Nadeem, 2018). From results of 59 samples of SWCs and the opinions expressed, in the earlier study (Khawaja & Ali, 2017; 2016), by 50 dermatologists/skin specialists, it is very evident that the continued use of mercury containing SWCs, the skin is affected, becomes unhealthy and ugly looking. Besides, mercury absorbed through the skin, causes adverse health problem to human. Such hazardous SWCs brand need not be used at all.

Media and advertisement have unequivocally connected skin fairness to magnificence, sentiment and even career success (Nadeem, 2018). There is dire need of public awareness through social, print & electronic media regarding the high level of hazardous mercury & other chemicals contents in SWCs and their effects both to the skin and human health. Educating the masses would in turn help reduce the burden of health costs on both the individuals as well as the government.

Similarly, social pressure on women to have white complexion for getting attention in society induces women to use skin whitening creams. Higher demand encourages cosmetic's manufacturers to produce SWCs in bulk quantity. So, besides awareness regarding negative health effects of SWCs, it is also direly needed to change concept of beauty through social media that "Healthy Skin is Beauty" and not the complexion.

At present, there does not seem to be an effective check and balance in place for the direly needed assessment of chemicals in consumer products by the Ministry of National Health Services, Regulations & Coordination/health departments, Pakistan Medical & Dental Council (PMDC), Pakistan National Accreditation Council (PNAC) or Drugs Regulatory Authority of Pakistan (DRAP). Specific regulations need to be developed and implemented, especially regarding standards for chemicals (like mercury) content in consumer products, including cosmetics/SWCs. All consumer products need to have proper labels (Mandatory), clearly indicating the amount of the chemicals added to the products, with updated contacts of the manufacturers.

Consumer products, containing excessive amount of chemicals be banned for use/sale/manufacturing. Last year, the "Public Notice" for general awareness and the action against Skin Cream manufacturers, by Pakistan Standards & Quality Control Authority (PSQCA), Karachi, Sindh province is appreciated and is a right step in the right direction and the same is most strongly recommended to be followed by the other provinces, GB & AJ&K governments (PSQCA, 2017/Annex 4). EPAs may also be involved in view of environmental pollution caused by chemicals use and resulting releases/wastes. It is also recommended that Higher Education Commission (HEC) looks into MBBS syllabus/curriculum for the needed additional information about cosmetics, especially SWCs, to be included for dermatology specialization.

Minamata Convention on Mercury be ratified by Pakistan (already signed) at the earliest. Mercury content in SWCs, exceeding the permissible limit (1ppm) should be considered potential risk to human health and their manufacturing, sale and use be phased out at the

earliest. We strongly recommend ban on the production/use of skin lightening creams with total mercury content above one ppm as per the requirement of Minamata Convention on Mercury.

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Annex IA: Product Information of Set A Skin Whitening Creams Samples Collected by MOCC

S N	Cream Name	Manufacturer	Brand	Date of Production	Date of Expiry	Sampling City/Location
1	Fair & Lovely Advanced Multi vitamin TM (Pakistani)	Uniliver Pakistan limited Avari Plaza, Fatima Jinnah Road, Karachi	Local	12-08-2017	12-08-2019	Student Shop, Anarkali bazar Lahore
2	BlushOn Beauty Cream	Blush On Cosmetic International 0321-9700034	Local	01-12-2015	01-12-2018	Face point shop Anarakali Bazar Lahore
3	White Gold Whitenin g Cream	NG	Local	10-2017	08-2020	Student Shop Anarkali Bazar Lahore
4	White Secret Beauty Cream	Alhamza Enterprises	Local	02-2018	02-2021	Classic Shop Liberty Lahore
5	Cherry Skin Whitenin g Cream	S.M Cosmetics Lahore Pakistan	Local	NG	Not Given	Classic Shop Liberty Lahore
6	9 Herbs WC	riad Mnuufacturing Company Mingora Swat	Local	12-2015	12-2019	Student Shop Anarkali Bazar Lahore
7	Era Beauty Cream	By Houston Texas Pakistan	Local	NG	06-2020	Classic Shop Liberty Lahore

8	Skin Clear Whitenin g Cream	N/A	Local	NG	N/A	Student Shop Anarkali Bazar Lahore
9	Denso Beauty Cream	MRC Cosmetics Lahore	Local	01-11-2016	01-11-2019	Student Shop (2) Anarkali Bazar Lahore
10	Zuni Beauty Cream (Female)	Zuni Cosmetics Pakistan Email: zunicosmetics@gmail.com	Local	NG	08-2020	Student Shop Anarkali Bazar Lahore
11	Zuni Beauty Cream For Men	Zuni Cosmetics Pakistan Email: zunicosmetics@gmail.com	Local	NG	12-2020	Student Shop Anarkali Bazar Lahore
12	Goree Beauty Cream	H Pharmacy Pakistan Email: info@hpharmacycosmetics.com	Local	06-2018	05-2020	Face Point Shop AnarakaliBaar Lahore
13	White Touch WC	Expert International Mingora Sawat (Halal)	Local	04-2016	04-2020	Student Shop Anarkali Bazar Lahore
14	Forever SWC	Ab Cosmetics, Lahore Pakistan	Local	01-2016	12-2018	Student Shop Anarkali Bazar Lahore
15	Current Fairness Cream	Meclay PVT. LTD Karachi Pakistan	Local	04-2016	12-2018	Classic Shop Liberty Lahore
16	Alpha White Beauty Cream	Alpha White Cosmatics	Local	11-2017	10-2020	Student Shop (2) Anarkali Bazar Lahore

17	Hemani Advance Herbal Whitenin g Cream	Hemani International KEPZ Karachi Pakistan Under Licence from Hemani Herbal LLC Orlando USA Tel: +1 8444 HEMANI	Local	NG		Face Point Shop Anarkali Bazar Lahore
18	Sandal Whitenin g Beauty Cream	M. Cosmatics Pakistan	Local	NG	03-2021	Ahmad Pharmacy 24, commercial zone, liberty market Gulberg III Lahore
19	Dermolit e Whitenin g Cream	A product of Dermolite Cosmetics Progressive Marketing CO Pakistan Halal	Local	01-2016	12-2020	Student Shop Anarkali Bazar Lahore
20	Infocus Pearl Beauty Cream	Infocus Cosmetology Co Pakitan	Local	11-2017	11-2020	Student Shop Anarkali Bazar Lahore
21	Biocos Emergen cy Whitenin g Cream,	Biocos International Pakistan Mob: 0300-0303520 Email: biocossosmetics@gmail.com	Local	03-2017	03-2020	Student Shop Anarkali Bazar Lahore
22	MAX dif skin brighteni ng cream	Manufactured by: Montis Pvt. Ltd katar bund road, Jinnah industrial area, off multan road, Lahore Pakistan	Local (Medic ated)	03-2018	03-2020	Ahmad Pharmacy 24, commercial zone, liberty market Gulberg III Lahore

		Jenpharm life sciences, cosmetic division Lahore Pakistan				
23	Hitone Whitenin g Cream	Crystolite Pharmaceutical(health care divison) plot no 72, S-2, National Industrial Zone, Rawat-Pakistan	Local(Medica ted)	05-2017	05-2020	Ahmad Pharmacy 24, commercial zone, liberty market Gulberg III Lahore
24	Olive Whitenin g cream	Under license & technical assistance "Herbal Experts" Spain	Internat ional	NG	08-07- 2021	Student Shop Anarakali Bazar Lahore
25	YC Whitenin g Pearl Cream	M.S. beautylineCo.,Ltd Bangkok Thailand	Internat ional	NG	06-2022	Student Shop Anarakali Bazar Lahore
26	Fair & Lovely Advance d Multi Vitamin	Unilever india Exports Limited, Plot no, 254 &256, sector no. 4 GandidhamGujrat	Internat ional	NG	07-2019	Classic shop liberty Lahore
27	Janssen Cosmetic s Brighteni ng Night Restore	Janssen Cosmetics Germany	Internat ional	NG		ENUM Store Liberty Market Lahore
28	Vince Skin Lightenin g Night Cream	In technical assistance with: King World LaboratriesSilverwater New South Wales Australia www.vincecare.com	Internat ional	NG	06-2020	AL-Fatah Shopping Mall Centaurs Islamabad

29	Olay Natural White	Procter & Gamble Manufacturing (Thailand) Ltd, 112 Moo 5, Bangsamark, bangpakongChachoengsao 24180 Thailand	International	NG	N/A	AL-Fatah Shopping Mall Centaurs Islamabad
30	Nivea Natural Fairness	Hamburg. Paris made in Thailand www.NIVEA.com	International	NG	N/A	AL-Fatah Shopping Mall Centaurs Islamabad
31	Ponds Flawless White	Milott Laboratories Co., Ltd, 84/55 MOO.11, SoiTanasitTeparak Rd. Bangpla, BangpleeSamutprakam 10540 Thailand	International	NG		AL-Fatah Shopping Mall Centaurs Islamabad
32	Eveline Cosmetics White Extreme, 3D	Eveline Cosmetics S.A 66 Avenue des champus-Elysees 75008 Paris, France Made In EU	International	NG	07-02-2020	AL-Fatah Shopping Mall Centaurs Islamabad
33	Garnier Light Complete White Speed	L'Oreal India Pvt.Ltd Chakan, Pune Email: Advisor.India@loreal.com	International	NG	05-12-2020	AL-Fatah Shopping Mall Centaurs Islamabad
34	Co Natural Whitenin g Cream	Conatural, F-10 Pace Towers, Fortress Stadium. Lahore Pakistan Phone No:+92-42-36623067 www.conaturalintl.com	Local	05-2018	01-2021	AL-Fatah Shopping Mall Centaurs Islamabad
35	Palmer's Skin Success	Palmer's Cosmetics E.T. Browne (U.K.)Ltd England	International	NG	NG	AL-Fatah Shopping

						Mall Centaurs Islamabad
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*NG= Not given

Annex IB: Product Information of Set B Skin Whitening Creams Samples Collected by SDPI

SN	SWC Name	Colour	Brand	State
1	Whiteface Whitening Cream	White	Local	Solid
2	Skin White Milk and Haldi Cream	Shiny yellow	Local	Semi-solid
3	Stillman's skin Bleach Cream	White	Local	Solid
4	Garnier Skin Naturals speed White	Light pink	International	Solid
5	Delicate Whitening Beauty Cream	Blue	Local	Solid
6	Fair and Lovely Max Fairness Multi-expert Face Cream	White		Liquid
7	Look fresh Beauty Cream	Green	Local	Solid
8	CinciBrido Whitening Cream	Off white	Local	Semi-solid
9	Due Whitening Cream	Green	Local	Solid
10	Skin White gold beauty Cream	Skin color	Local	Solid
11	White Gold Whitening Cream with blackberry extracts	Light green	Local	Solid
12	Pure White Beauty Whitening Cream	Off-white	Local	Solid
13	Garnier skin naturals white complete	Off-white	International	Semi solid
14	Ponds White Beauty Cream	Light pink	International	Semi-solid
15	Parley Herbal Whitening Cream	Light green	Local	Solid

16	Sandal Whitening Beauty Cream	Off-white	Local	Solid
17	Face Fresh Cleanser Cream	Yellowish white	Local	Gelatinous solid
18	White Face Whitening Cream	Pink	Local	Solid
19	Face tonic whitening Formula	Pink	Local	Solid
20	Fair and lovely	White	Local	Liquid
21	Winsome Whitening Beauty Cream	Yellow	Local	Solid
22	Gipsy with Jojoba Oil	Off-white	Local	Solid
23	Permanent Whitening Cream	Skin color	Local	Solid
24	Leads Whitening Cream	Light purple	Local	Solid

*NG= Not given

Annex 2: Purchased Set B Skin Whitening Creams (SWCs)

SN	City	Outlet Name	Date Of Purchase	Address	Items Purchased	Total Cost
1	Karachi	Bin Hashim	03-01-16	SB-C1 Block 14 Gulshan-E-Jauhar Near Dar-UI-Sahar, Karachi-021-34663710-15	11	2,975
2	Lahore	Khalid Pharmacy	14-01-16	T-Block, DHA Lahore-042-35707390-91	8	1530
3	Lahore	General Store	13-01-16	Upper Mall Scheme Lahore	4	965
4	Lahore	Paradise Store	14-01-16	2-S, Commercial Area. Phase 2, DHA Lahore-042-5725947	2	450
5	Haripur	Fashion For Fashion Boutique	05-12-15	D-Stop GT Road Haripur-0313-5865074	3	265
6	Islamabad	Lucky Chemist	06-01-16	Shop 7-8, AAA Plaza, G-10 Markaz Islamabad-051-2350332	3	150
7	Islamabad	Hi Choice cash and carry	13-01-16	G-10 markaz Islamabadtel: 051-23534714-15	10	1200
8	Peshawar	Prime medicos and general store	25/3/2016	Shop 5, cantt medical center, dabgari garden Peshawar	4	785
9	Peshawar	Blue bells cosmetics	24/3/2016	Abdarachowk, university road Peshawar	2	500

Annex 3: Results of the Concentrations (ppm) of Mercury (Hg) in Skin lightening Cream Samples

SN	Sample ID	Sample Color	Hg Content (ppm)
1	C001	White	5.02 (H)
2	C002	White	65 (I)
3	C003	Orange	19069 (I)
4	C004	Light Apple Green	10369 (I)
5	C005	Shocking Pink	15710 (I)
6	C006	Half White	2420 (I)
7	C007	Pink	2458 (I)
8	C008	Yellow	21 (I)
9	C009	Peach	9681 (I)
10	C0010	Light Brown	15973 (I)
11	C0011	White	18177 (I)
12	C0012	Light Green	4.39 (H)
13	C0013	White	1257 (I)
14	C0014	Light Yellow	8181 (I)
15	C0015	White	8.45 (H)
16	C0016	Half White	3923 (I)
17	C0017	Pink	2.59 (H)
18	C0018	Half White	15566 (I)

19	C0019	Light Brown	6035 (I)
20	C0020	Gray	14493 (I)
21	C0021	Half White	5129 (I)
22	C0022	White	16004 (I)
23	C0023	Brown	9.11 (H)
24	C0024	White	8.31 (H)
25	C0025	White	0.93 (H)
26	C0026	White	1.43 (H)
27	C0027	White	1.82 (H)
28	C0028	White	21.35 (H)
29	C0029	Light Peach	5.41 (H)
30	C0030	White	4.20 (H)
31	C0031	White	0.74 (H)
32	C0032	White	9.27 (H)
33	C0033	White	2.11 (H)
34	C0034	Light Brown	1.88 (H)
35	C0035	White	1.94 (H)
36	IC-34	Light pink	324.72(H)
37	IC-35	Shiny yellow	0.80 (H)
38	IC-36	White	44292 (I)
39	IC-38	Light pink	1.98 (H)

40	IC-39	Blue	23780 (I)
41	IC-40	White	21 (I)
42	IC-41	Green	7912 (I)
43	KC-37	Off-white	1479 (I)
44	KC-50	Green	16805 (I)
45	LC-21	Skin	13.49 (H)
46	LC-22	Light green	15795 (I)
47	LC-23	Off-white	7862 (I)
48	LC-24	Off-white	15.52 (H)
49	LC-25	Light pink	5.01 (H)
50	LC-26	Light green	40131 (I)
51	LC-27	Off-white	12044 (I)
52	LC-28	Yellowish white	19 (I)
53	LC-29	Pink	14895 (I)
54	P-42	Pink	1405 (I)
55	P-43	White	40 (I)
56	P-44	Yellow	18173 (I)
57	P-45	Off-white	36.29 (H)
58	X-46	Skin	128 (I)
59	X-47	Light purple	13658 (I)

Techniques used for Mercury Analysis: (H) HGASS (I) ICP.OES

Annex 4: Public Notice for General Awareness and the Action against Skin Cream Manufacturers, by PSQCA

**BUSINESS
RECORDER**

Simultaneously published from Karachi, Lahore & Islamabad
 Founded by M. A. Zuberi

Public Notice
Skin Cream Manufacturers

This is to advertise for Manufacturers of Skin Cream and general public that In exercise of the power under section 14 of the Pakistan Standards & Quality Control Authority (PSQCA) Act-VI 1996, the Government of Pakistan has empowered PSQCA to prohibit the Manufacturing, storage & sale of the following if they that do not conform to the relevant Pakistan Standard Specifications (PSS) as follows:

SRO No.	Dated	PSS No.	PSS Title
46(KE)/2017	10-05-2017	PS:3228/2017	Skin Cream

In order to avoid any penal action All the manufacturers are advised, in their own interest to get their product registered / Certified with PSQCA within 15 days of Publication of this Public Notice. The details are available at web site or call at Toll free Number of PSQCA. 0800-80000

SAY NO TO SUB-STANDARD PRODUCTS
A sign of safety, reliability and satisfaction

Pakistan Standards & Quality Control Authority
Ministry of Science & Technology, Government of Pakistan

Secretary PSQCA Pak Sectr Block No. 77, Saddar, Karachi Tel: 021-99206519	Director CA-North 308 Hillman Heights, Hilal Road F-11-1, Islamabad, Tel: 031-2234834	Director CA-South PSQCA Complex, 7/A, Block 3, Scheme 36, Gulistan-e-Johar, Karachi. Tel: 021-99261847	Deputy Director CA-North Plot No. 12, Sector B-II, Phase V, Hayatabad, Peshwar, Tel: 0791-9217883	Director CA-Central 125-A, Industrial Area Kot Lakhpat, Lahore. Tel: 042-35213420
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Google play

Public Notice for General Awareness and the Action against Skin Cream Manufacturers, by PSQCA

PSQCA
means Quality

PSQCA has launched monitoring activity of Beauty Creams. Units producing sub-standard creams containing hazardous ingredients to the human skin are being seized.

All consumers must ensure to buy skin/whitening creams only having PSQCA certification (PS mark)



PSQCA-Complex, Plot # ST-7/A, Block-3, Scheme-36, Gulshan-e-Johar, Karachi
Tel: (021) 99261858 E-mail: media@psqca.gov.pk Website: www.psqca.com.pk



SDPI
Sustainable Development Policy Institute

Ministry of Climate Change, Government of Pakistan

R&D Complex, G-5/2, Islamabad-Pakistan

Sustainable Development Policy Institute

Block D, G 6/2 Blue Area, Islamabad-Pakistan

