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Bacterial Contamination Analysis Based On Total Plate Count From Various Uses Of Compact Powder

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ABSTRACT

The repeated and alternating use of compact powder can increase the risk of bacterical contamination. This contamination can be harmful to the skin health of the users, especially if the compact powder used has been contamination with bacteria exceeding the standard limit set by BPOM, which is 5 × 10³ colonies/g or colonies/mL. Therefore, an analysis of bacterial contamination in the repeatedly and alternately used sompact powder from various uses is necessary using the Total Plate Cound (TPC) method to ensure the suitability and safety of the compact powder. The objective is to determine the level of bacterial contamination based on the Total Plate Cound (TPC) on compact powder used by makeup artists, tester from cosmetic stores, personal use dan new product. The samples of conpact powder analyzed amounted to 24 samples, using purposive sampling technique and the data was analyzed descriptively. The result obtained from the calculation of the average number of bacterical colonies in personal use compact powder, new product and tester from each cosmetic store are < 3 x 10¹ CFU/g, while the average for compact powders sourced from makeup artists is 1.66 x 10^5 CFU/g. Compact powder derived from personal use, new products, and those used as testers by cosmetic stores show ALT values that still fall within the category of meeting the standards set by BPOM. Meanwhile, compact powder derived from makeup artists shows ALT values that exceed the standards set by BPOM.

INTRODUCTION

Appearing attractive is considered highly important for women, and one of the ways to enhance appearance is through the use of cosmetics, including compact powder. Compact powder is commonly used repeatedly in daily life, whether for personal use, by makeup artists, or as testers provided in cosmetic stores, often without proper attention to hygiene, which may lead to bacterial contamination. Several previous studies have shown the presence of bacterial contamination in cosmetics used repeatedly, including *Staphylococcus aureus* and *Pseudomonas aeruginosa* (Neza & Cetini, 2016). Susmiati (2019) found that the Total Plate Count (TPC) in used compact powder samples exceeded the maximum microbial contamination limit set by BPOM Regulation No. 12 of 2019. Similarly, a study by Munira et al. (2020) reported an increase in bacterial colonies after two weeks of compact powder usage. However, there has been limited research specifically examining bacterial contamination levels based on different types of product use. Therefore, this study aims to analyze bacterial contamination based on Total Plate Count (TPC) in compact powder products used under various conditions (new products, personal use, tester use, and use by

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makeup artists) to determine whether the microbial contamination remains within the safety limits set by BPOM (Jiwantoro & Putri, 2023). This research also seeks to provide valuable information to the public regarding the importance of maintaining cosmetic hygiene to prevent the risk of infection due to bacterial contamination.

MATERIALS/METHOD

This study adopts a descriptive research design, which aims to describe the condition of the variables under investigation without manipulating them. The descriptive approach is appropriate for providing an overview of the presence or level of bacterial contamination in compact powder based on different usage types (Jiwantoro YA, Diarti MW, & Anggraeni NPDA, 2023). Furthermore, the study applies a cross-sectional approach, in which data collection and observation are conducted at a single point in time or within a specific period (Sugiyono, 2017). Each sample or subject is observed only once, allowing the researcher to capture a snapshot of bacterial contamination without longitudinal follow-up (Setiawan & Prasetyo, 2015).

RESULTS AND DISCUSSION

Table 1. Bacterial Colony Quantification Data

Sample Code	Dilucion	Coloni Count	Remarks
New			
BR 1	10^{-3}	2	TFTC
	10^{-4}	0	TFTC
BR 2	10^{-3}	0	TFTC
	10^{-4}	2	TFTC
BR 3	10^{-3}	0	TFTC
	10^{-4}	1	TFTC
BR 4	10^{-3}	0	TFTC
	10^{-4}	0	TFTC
BR 5	10^{-3}	1	TFTC
	10^{-4}	0	TFTC
BR 6	10^{-3}	1	TFTC
	10^{-4}	1	TFTC
Sample Code	Dilution	Coloni Count	Remarks
Tester			
TS 1	10^{-3}	4	TFTC
	10^{-4}	5	TFTC
TS 2	10^{-3}	3	TFTC
	10^{-4}	3	TFTC
TS 3	10^{-3}	0	TFTC
	10^{-4}	3	TFTC
Sample Code	Dilution	Coloni Count	Remarks
TS 4	10^{-3}	352	TMTC
	10^{-4}	4	TFTC
TS 5	10^{-3}	4	TFTC
	10^{-4}	0	TFTC
TS 6	10^{-3}	5	TFTC
	10^{-4}	8	TFTC
Personal Use			
PR 1	10^{-3}	0	TFTC
	10^{-4}	0	TFTC
PR 2	10^{-3}	4	TFTC
	10^{-4}	0	TFTC
PR 3	10^{-3}	12	TFTC
	10^{-4}	9	TFTC
PR 4	10^{-3}	3	TFTC
	10^{-4}	1	TFTC
PR 5	10^{-3}	13	TFTC
	10^{-4}	3	TFTC
PR 6	10^{-3}	3	TFTC
	10^{-4}	1	TFTC

Sample Code	Dilucion	Coloni Count	Remarks
MuA			
MA 1	10^{-3}	59	Valid
	10^{-4}	3	TFTC
MA 2	10^{-3}	1	TFTC
	10^{-3}	40	Valid
MA 3	10^{-4}	0	TFTC
	10^{-3}	3	TFTC
MA 4	10^{-3}	40	Valid
	10^{-4}	2	TFTC
MA 5	10^{-3}	4	TFTC
	10^{-4}	0	TFTC
MA 6	10^{-3}	20	TFTC
	10^{-4}	2	TFTC

Additional explanation :

	Valid	= 30 – 300 koloni
	TFTC	= Too Few To Count (Terlalu Sedikit Untuk Dihitung)
	TMTC	= Too Much To Count (Terlalu Banyak Untuk Dihitung)

Based on the research results presented in Table 4, bacterial colony growth was observed. Out of 24 samples, 3 samples met the criteria for Total Plate Count (TPC) calculation (30–300 colonies), namely compact powder used by makeup artists. The sample coded MA1 at a 10^{-3} dilution showed 59 colonies, MA2 at a 10^{-4} dilution showed 40 colonies, and MA3 at a 10^{-3} dilution showed 40 colonies.

Table 2. The calculation of Total Plate Count (TPC) :

Sample Code	**Dilution**	**TPC**
New		
BR 1	10^{-3}	-
	10^{-4}	-
BR 2	10^{-3}	-
	10^{-4}	-
BR 3	10^{-3}	-
	10^{-4}	-
BR 4	10^{-3}	-
	10^{-4}	-
BR 5	10^{-3}	-
	10^{-4}	-
BR 6	10^{-3}	-
	10^{4}	-
Average :		$< 3 \times 10^{1}$
Sample Code	Dilution	TPC
Tester		
TS 1	10^{-3}	-
	10^{-4}	-
TS 2	10^{-3}	-
	10^{-4}	-
TS 3	10^{-3}	-
	10^{-4}	-
TS 4	10^{-3}	-
	10^{-4}	-
TS 5	10^{-3}	-
	10^{-4}	-
TS 6	10^{-3}	-
	10^{-4}	-
Average :		$< 3 \times 10^{1}$
Sample Code	Dilution	TPC
Personal use		
PR 1	10^{-3}	-
	10^{-4}	-
PR 2	10^{-3}	-
	10^{-4}	-
PR 3	10^{-3}	-
	10^{-4}	-
PR 4	10^{-3}	-
	10^{-4}	-
PR 5	10^{-3}	-
	10^{-4}	-

Sample Code	Dilution	TPC
PR 6	10^{-3}	-
	10^{-4}	-
Average :		< 3 x 10^{1}
Sample Code	Dilution	TPC
MuA		
MA 1	10^{-3}	$5\ x\ 10^{4}$
	10^{-4}	-
MA 2	10^{-3}	-
	10^{-4}	$4\ x\ 10^{5}$
MA 3	10^{-3}	-
	10^{-4}	-
MA 4	10^{-3}	$4\ x\ 10^{5}$
	10^{-4}	-
MA 5	10^{-3}	-
	10^{-4}	-
MA 6	10^{-3}	-
	10^{-4}	-
Average :		$1{,}66\ x\ 10^{5}$

Additional explanation :
BR : New Product
TS : Tester from cosmetic store
PR : Personal use
MA : Makeup artist
: ALT valid

Based on the results presented in Table 5, bacterial colony counts that met the criteria for Total Plate Count (TPC) calculation were used to determine the average TPC. The average colony count for compact powder from personal use, new products, and testers from cosmetic stores was less than 3×10^{1}. In contrast, the average colony count for compact powder used by makeup artists was 1.66×10^{5}.

Based on the results of this study, compact powder samples from new products, personal use, and testers provided by cosmetic stores each had an average bacterial count of $< 3 \times 10^{1}$ CFU/g. This occurred because, in these groups, there were no bacterial colony counts within the acceptable range of 30–300 colonies on the culture media, which is required for valid Total Plate Count (TPC) analysis. All observed colony counts fell below the quantification limit acceptable for TPC calculation. In contrast, compact powder used by makeup artists showed bacterial colony growth that met the criteria for TPC calculation. The number of colonies recorded was 59 in sample MA1 at a 10^{-3} dilution, 40 in sample MA2 at 10^{-4}, and 40 in sample MA3 at 10^{-3} dilution. As a result, the average TPC for compact powder from makeup artists was 1.66×10^{5} CFU/g.

The differences in TPC results across the samples analyzed may be associated with the responses from the supporting questionnaire. The questionnaire showed that tester powders in cosmetic stores were the most frequently used, with an average of 1–5 uses per day. Compact powders from personal users and makeup artists were each used approximately 2–3 times per day. Regarding application methods, both personal users and makeup artists applied the powder using the original sponge provided with the product. Meanwhile, tester products were typically applied directly with consumers' bare fingers, without any tools. In terms of storage, personal users and makeup artists were more attentive to hygiene and product safety, storing their powders in closed containers in dry places. Conversely, tester products were stored in open display cases that were easily accessible to customers. Regarding applicator hygiene, only makeup artists reported regularly washing or replacing the sponge monthly. In contrast, personal users rarely or never cleaned their applicators, and tester products did not use applicators at all, as consumers applied the product directly with their fingers.

Regarding awareness of bacterial contamination, personal users and store owners generally understood that repeated cosmetic use without proper hygiene could lead to

bacterial contamination. However, most makeup artists were unaware of the risks associated with repeated and shared product use without proper hygiene, which can potentially lead to contamination harmful to health.

Therefore, the findings of this study indicate that the highest level of bacterial contamination was found in compact powder used by makeup artists, with an average TPC of 1.66×10^5 CFU/g, which exceeds the maximum limit set by the Indonesian National Agency of Drug and Food Control (BPOM) in Regulation No. 12 of 2019 concerning Microbial Contamination in Cosmetics, which is 5×10^3 CFU/g. In contrast, compact powders from personal use, new products, and tester products remained within the acceptable limits set by BPOM, with an average TPC of $< 3 \times 10^1$ CFU/g (Chung WS et al., 2016).

CONCLUSIONS

Bacterial colony growth was observed in all compact powder samples analyzed, including those from personal use, testers provided by cosmetic stores, new products, and those used by makeup artists. The average total bacterial count for compact powders from personal use, new products, and store testers was found to be $< 3 \times 10^1$ CFU/g, while powders used by makeup artists had a significantly higher average of 1.66×10^5 CFU/g. The results indicate that compact powders from personal use, new products, and store testers remain within the acceptable microbial limits established by BPOM regulations. In contrast, the bacterial contamination level in compact powders used by makeup artists exceeded the maximum allowable limit, suggesting poor hygiene practices and a higher potential risk of microbial transmission in such settings.

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