International Journal of Advanced Health Science and Technology (IJAHST)
Multidisciplinary : Rapid Review : Open Access Journal e-ISSN:2808-422; p-ISSN:2829-3037

RESEARCH ARTICLE OPEN ACCESS

Manuscript received July 16, 2024; revised July 30, 2024; accepted July 30, 2024; date of publication August 29, 2024

Digital Object Identifier (**DOI**): https://doi.org/10.35882/ijahst.v4i4.382

How to cite: Ayu Pratiwi Trisnawati, Sri Hidayati, Silvia Prasetyowati, and Sunomo Hadi, "Assessment of Toilet Cleaning Practices and Mold Presence in Public Toilets at Sunan Ampel Tourism Site, Surabaya: A Descriptive Study", International Journal of Advanced Health Science and Technology, vol.4, no.4, pp. 267 - 272 August 2024

Assessment of Toilet Cleaning Practices and Mold Presence in Public Toilets at Sunan Ampel Tourism Site, Surabaya: A Descriptive Study

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ABSTRACT Toilet cleanliness can be used as an indicator of the sanitation management level of a place. Toilet cleanliness can be influenced by the environment around the toilet, the behavior of the cleaning staff and the people using it, as well as the cleaning process that may allow mold to grow in the toilet basin, which can cause diseases for the users. The purpose of this study is to describe the toilet cleaning process and the presence of mold in the toilet basins at the public toilets in Sunan Ampel Tourism Site, Surabaya. This study is descriptive in nature. The objects in this study were 30 toilets. Data analysis was performed by comparing data from observations and laboratory examinations of the presence of mold in public toilet basins with the provisions of PMK No. 17 of 2020 and the Indonesian Public Toilet Standard Guidelines. The results of the toilet cleaning process assessment showed that 23 (77%) toilets were categorized as "Fair" and 7 (23%) toilets were categorized as "Good". The presence of mold in the toilet basins was found in 19 (63%) toilets, while 11 (37%) toilets were mold-free. Based on the research results and discussion, it can be concluded that temperature and humidity factors, clean water quality, visitor frequency, and toilet basin cleaning can influence mold growth in toilet basins. Fungi produce secondary metabolites that are toxic and act as pathogens in humans or cause allergies

INDEX TERMS Cleaning Process, Presence Of Mold, Public Toilet.

I. INTRODUCTION

Public places are locations where many people gather to do certain activities. Disease, environmental pollution, and other health problems can spread in public places. Hygiene conditions in public places must be continuously monitored to protect the community from the transmission of various disease and other health issues [1]. Public places that are required to maintain environmental sanitation include commercially managed public places, those that encourage the spread of disease, or places where many people gather such as tourist attractions [2]. Tourist attractions are one type of public place that requires clean and adequate facilities. Public toilets are part of the sanitation facilities in public places. At tourist attractions, public toilet facilities are often neglected in terms of both availability and cleanliness [3].

Toilet cleanliness can reflect the sanitation management of a place. One of the parameters of toilet cleanliness is the process of cleaning the toilet tank and changing the water. Draining public toilet tanks less than twice a week can allow mold to grow in the water and cause disease for its users. Toilet cleanliness can be affected by the surrounding environment of the toilet, the behavior of the people using it, as well as the cleaning process of the toilet, which can allow mold to grow in the toilet tank [4].

Fungi generate secondary metabolites and some of these are toxic. Certain fungal species and their metabolites can act as pathogens in humans or cause allergic [5]. Mold can pose potential health hazards, and its growth can also cause damage and discoloration to toilet facilities and buildings [6]. A study [7] found the presence of pathogenic fungi *Trichophyton*, *Aspergillus*, *Penicillium* and *Candida* in gas station toilets. Another study [8] showed that the fungi *Aspergillus*, *Candida albicans*, *Trichophyton*, *Rhizopus*, and *Penicillium* were found in the water of toilet tanks at the Arosbaya Subdistrict Mosque in Bangkalan City.

Pathogenic fungi cause infections that can manifest as pneumonia, candidemia, mucormycosis, and mycosis [9]. Mycosis in an infection caused by fungi and tends to be chronic due to the slow growth of the fungi [10]. One of the disease caused by mycosis due to pathogenic fungi is

dermatophytosis. The condition caused by the growth of dermatophyte fungi in tissues that contain keratin, such as the skin layer, hair, and nails, is known as dermatophytosis [11]. The city of Surabaya still faces a high rate of skin disease. Data from the Surabaya City Health Office in 2019 shows that skin and subcutaneous tissue diseases rank sixth among the ten most common diseases, with a rate of 4.53%.

The residential area of Sunan Ampel Tourism in Surabaya, located in the northern part of Surabaya, has now become a religious tourist destination. Each year, the number of people visiting this place increases significantly. According to data from the Department of Culture and Tourism (Disbupdar) of Surabaya City, at least 1.968.452 people visited this place from January to December 2019 [12]. Religious Tourism of Sunan Ampel in Surabaya is frequently visited because it has a unique attraction for muslims to make pilgrimages to the grave of Sunan Ampel. The risk of disease transmission can increase due to the large number of visitors and the lack of maintenance of sanitation facilities.

The preliminary survey results revealed that the toilets were not clean, the floor surface were slippery, there was scale on the surface of the toilet doors, and moss/stains on the surface of the water storage wank walls. The water used for hygiene and sanitation came from a well, and covered trash bins were not available in some toilets. There were three cleaning staff on duty. The cleaning of the toilet tanks was done by scrubbing the tanks without using any cleaning solution. The initial examination results for the mold count in one of the toilet tanks at Religious Tourism of Sunan Ampel Surabaya showed < 10 CFU/ml, which does not meet the requirements according to the Public Toilet Standards Guidelines in Indonesia, which is 0 CFU/ml. The purpose of this study is to describe the toilet cleaning process and the presence of mold in the public toilet tanks at Sunan Ampel Tourism in Surabaya.

II. METHOD

This research is descriptive and aims to provide an overview of the phenomena occuring. The study was conducted at the Sunan Ampel Surabaya tourist site in March 2024. The objects of this research are all toilets at the Sunan Ampel Surabaya tourism site, consisting of permanent or non-permanent toilet basins, totaling 30 toilets. The sample examination was conducted at the Surabaya Public Health Laboratory. Sampling was carried out by swabbing the walls of the toilets with sterile cotton swabs and buffer solution. The sample collection procedure is as follows:

1. Prepare sterile gloves before starting sample collection
2. Collect the sample using a sterile cotton swab that has been dipped in buffer solution, following aseptic procedures and performed near a flame
3. Swipe the cotton swab on the wall at the sampling point with a diagonal motion three times. Then, insert the cotton swab into a test tube containing buffer solution
4. Label each sample and place it in a coolbox.

The data collection instrument used in this research refers to PMK No. 17 of 2020 concerning Health Markets and the Indonesian Public Toilet Standards Guidelines. The data collection technique in this study involves observation through monitoring to evaluate the cleaning process and sanitation conditions of public toilets, laboratory examination for the presence of mold in toilet bowls, and measurement of temperature and humidity in the toilets using a hygrometer. Data analysis was conducted by comparing the observation data and laboratory results of mold presence in public toilet bowls with the provisions of PMK No. 17 of 2020 and the Indonesian Public Toilet Standards Guidelines.

III. RESULTS

This research results include a general overview of the findings from the observations and laboratory examination of the presence of mold in public toilet bowls.

A. PUBLIC TOILET CLEANING PROCESS

The assessment of the toilet cleaning process was conducted on 30 toilets at the Sunan Ampel Surabaya tourist site, consisting of 17 women's toilets and 13 men's toilets, and the results are as follows:

TABLE 1
Results Of The Cleaning Process Assessment Of Public Toilets At The Sunan Ampel Tourist Site Surabaya In 2024

Category	Frequency	Percentage (%)
Poor	0	0
Adequate	23	77
Good	7	23
Total	30	100

The assessment results of the public toilet cleaning process at the Sunan Ampel Surabaya tourist site showed that out of 30 toilets evaluated, 23 (77%) were categorized as "Adequate".

B. PUBLIC TOILET SANITATION CONDITIONS

The assessment of public toilet sanitation conditions is based on the Indonesian Public Toilet Standards and PMK No. 17 of 2020.

TABLE 2
Results Of The Sanitation Condition Of Public Toilets At The Sunan Ampel Tourist Site Surabaya In 2024

Category	Frequency	Percentage (%)
Poor	0	0
Adequate	19	63
Good	11	37
Total	30	100

The assessment results of the public toilet sanitation conditions at the Sunan Ampel Surabaya tourist site showed that out of 30 toilets evaluated, 19 (63%) were categorized as "Adequate". This assessment is conducted through observations using observation sheets and includes the

physical environmental quality, provision of clean water, and public toilet facilities and infrastructure.

1. THE PHYSICAL ENVIRONMENTAL QUALITY OF PUBLIC TOILETS

The assessment of the physical environmental quality of toilets includes several evaluation variables, such as lighting, ventilation, temperature and humidity of the toilet:

TABLE 3
Results Of The Physical Environmental Quality Assessment Of Public Toilets At Sunan Ampel Tourist Site Surabaya In 2024

Category	Frequency	Percentage (%)
Poor	19	63
Adequate	11	37
Good	0	0
Total	30	100

Based on the assessment results in TABLE 3. it is known that of the 30 toilets evaluated for physical environmental quality, 19 (63%) fall into the "Poor" category.

2. PROVISION OF CLEAN WATER IN PUBLIC TOILETS

The assessment of clean water provision in toilets includes variables of water quality and availability, with the following results obtained:

TABLE 4
Results Of The Clean Water Provision Assessment In Public Toilets At The Sunan Ampel Tourist Site Surabaya In 2024

Category	Frequency	Percentage (%)
Poor	0	0
Adequate	0	0
Good	30	100
Total	30	100

Based on TABLE 4. it is known that all 30 toilets assessed for clean water provision fall into the "Good" category. The provision of clean water in the public toilets at Sunan Ampel Surabaya has met the requirements for quality and quantity according to PMK No. 17 of 2020 and the basic guidelines for the provision of clean water for public toilets

3. FACILITIES AND INFRASTRUCTURE OF PUBLIC TOILETS

Assessment of toilet facilities and infrastructure conducted based on the Indonesia Public Toilet Standard Guidelines and Regulation of The Minister of Health No. 17 of 2020.

TABLE 5
Results Of The Facilities And Infrastructure Assessment Of Public Toilets At The Sunan Ampel Tourist Site Surabaya In 2024

Category	Frequency	Percentage (%)
Poor	0	0
Adequate	0	0
Good	30	100
Total	30	100

Based on TABLE 5. it is known that all 30 toilets assessed for facilities and infrastructure fall into the "Good" category.

C. PRESENCE OF MOLD IN PUBLIC TOILET TANKS

Examination of the presence of mold in public toilet tanks was conducted by taking swab samples from the walls of the toilet tanks at Sunan Ampel Surabaya tourist site, and the results obtained are as follows:

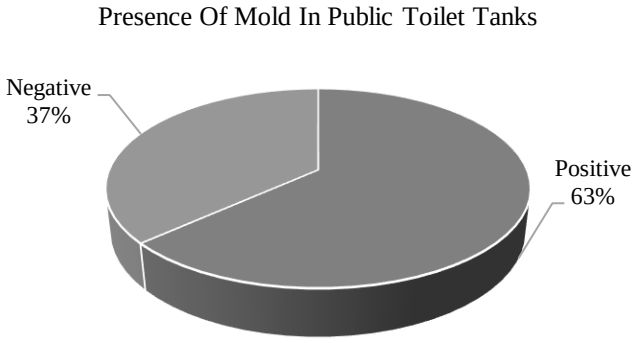

FIGURE 1. Laboratory Examination Results Of Mold Presence in Public Toilet Tanks at Sunan Ampel Surabaya Tourist Site in 2024

The swab sample examination was conducted at the Surabaya Public Health Laboratory Center, and from the 30 samples examined, 19 (63%) toilets were found to be positive for mold presence and 11 (37%) toilets were found to be negative for mold presence.

IV. DISCUSSION

A. PUBLIC TOILET CLEANING PROCESS

Observations revealed that the toilet cleaning staff did not use complete personal protective equipment such as masks, gloves, and aprons while on duty, which exposes them to potential risks from disinfectant chemicals and their work environment. Article 4 of the Ministry of Manpower Regulation No. 8 of 2010 mandates the use of Personal Protective Equipment in workplaces that are corrosive, toxic, or infectious, such as during cleaning, waste disposal or handling hazardous materials. This is consistent with research [13] which states that toilet cleaning staff are in a job category that can cause occupational health problems due to exposure to tools. Research [14] indicates that cleaning staff are in a high-risk group for various disease and accidents caused by the working conditions the face.

The toilet cleaning staff clean the walls and doors both inside and outside the toilet, as well as the buckets and dippers. However, they do not clean the ceiling because the toilet building is still new. The cleaning of the toilet bowl (place for defecation) is done by scrubbing the inside of the toilet with a brush and cleaning fluid, followed by rinsing all surfaces of the toilet bowl with a cleaning cloth.

The toilet tank is drained twice a week. Cleaning of the toilet tank is done using a brush without cleaning fluid, which may allow mold to grow in the toilet tank. Research [15] explains that the growth of mold in the water of the toilet tank can occur because the toilet and toilet tank are not cleaned and drained using germicidal carbolic. Research [8] states that insufficient cleaning of the water tank can cause mold to appear in the water, which can lead to infections for its users.

B. PUBLIC TOILET SANITATION CONDITIONS

The assessment of toilet sanitation conditions was conducted on 30 toilets located at the Sunan Ampel Tourist Site in Surabaya by observing the physical environment quality, clean water provision, and toilet facilities. The indicators for assessing toilet sanitation conditions at the Sunan Ampel Tourist Site in Surabaya are as follows:

1. THE PHYSICAL ENVIRONMENTAL QUALITY OF PUBLIC TOILETS

Based on the lighting measurements, it was found that out of 30 toilets, 19 (63%) had a light intensity of less than 100 Lux, specifically 82 Lux, where as according to the Indonesian Public Toilet Standard Guidelines, public toilets must meet the minimum hygiene and sanitation standard of at least 100 Lux for lighting. The humidity in all toilets was more than 40%-50%, with 68.8% for women's toilets and 66.7% for men's toilets. The air temperature in all toilets was more than 20ºC-27ºC, with 29.5ºC for women's toilets and 28.5ºC for men's toilets, while according to the Indonesian Public Toilet Standard Guidelines, public toilets must meet the minimum hygiene and sanitation standard for humidity of 40%-50%, and a normal temperature of 20ºC-27ºC [16]. Air temperature and humidity have a closely related relationship. When the temperature rises, the humidity level tends to decrease, and conversely, when the temperature drops, the humidity level tends to increase [17]

2. PROVISION OF CLEAN WATER IN PUBLIC TOILETS

The provision of clean water in the public toilets at Sunan Ampel Surabaya has met the requirements for quality and quantity according to PMK No. 17 of 2020 and the basic guidelines for the provision of clean water for public toilets, which is 2-8 liters/person/day. The clean water used for sanitation needs comes from well water. Water stored in toilet tanks for hygiene purpose can be contaminated by various contaminants, including microorganisms. This is accordance with the statement [18] that water used daily can be contaminated by disease-causing microorganisms such as viruses, bacteria, fungi, worms, and protozoa. Water used for sanitation needs must be free from pathogenic microorganisms, including fungi. Fungi can be a source of contaminants in water [19]. Fungi can be pathogens, allergens, and even contain toxins [20]. Fungi can adapt to changing environmental conditions. Certain ions, changes in acidity (pH), temperature, sunlight exposure, and organic substances can affect the presence of fungi in water sources [21].

3. FACILITIES AND INFRASTRUCTURE OF PUBLIC TOILETS

The facilities available in the public toilets at Sunan Ampel Surabaya Tourist Site include waterproof floors that are non-slip and easy to clean, signs distinguishing men's and women's toilets, toilets that meet health requirements, toilet brushes and cleaning soap, and water storage tanks free from larvae. However, some facilities are not available, such as covered trash bins, hand washing stations, and toilet paper, which do not comply with the Indonesian Public Toilet Standard Guidelines. According to Indonesia's official tourism website, the Sunan Ampel Religious Tourism Center in Surabaya receives an average of 1.500-2.000 visitors every day [22]. Based on the number of toilets and the average number of visitors at the location, the available toilets do not meet the capacity requirements for toilets at tourist sites according to the Indonesian Public Toilet Standard Guidelines, which is 1 toilet per 25 to 100 people.

C. PRESENCE OF MOLD IN PUBLIC TOILET TANKS

The examination of mold presence in the toilet tanks at Sunan Ampel Surabaya Tourist Site was conducted by taking swab samples from the walls and performing laboratory tests at the Surabaya Public Health Laboratory Center. Based on the laboratory examination results, out of 30 toilet samples tested, 19 (63%) toilets were positive for mold presence, and 11 (37%) toilets were negative for mold presence. According to the Indonesian Public Toilet Standard Guidelines, the acceptable mold count in water storage tanks is 0 CFU/ml. Mold can be found in various places, and exposure to mold can cause allergies, infections, and other health problems.

The environment around the toilet also contributes to the contamination of toilet water tanks. The surrounding area is quite damp, and the lack of trash bins can cause waste discarded by toilet users to become a source for fungal growth [4]. The growth of mold in toilet tanks can be due to not cleaning the tanks with a brush and cleaning fluid. This is consistent with the statement [4] that the method of cleaning toilet tanks also affects the level of mold contamination. Toilet cleaned with a brush and cleaning soap result in a smaller quantity of mold compared to tanks cleaned only with a brush without using cleaning soap [23].

Apart from the toilet cleaning process, mold growth in toilet tanks can also be caused by temperature and humidity. Pathogenic fungi can cause disease in humans, these fungi easily grow in damp and tropical environments. Based on the temperature measurements, the toilet reached 28ºC and the humidity was 68.8% for women's toilets and 66.7% for men's toilets. These temperature and humidity levels can allow for the growth and development of mold. This is

consistent with the statement [24] that most molds can grow optimally at temperatures between 25ºC-28ºC. Additionally, humidity is a key factor in mold growth [15]. Mold will thrive in environments with humidity levels above 60% [17].

Mold contamination from untreated water sources can cause disease. Observations indicate that well water or groundwater is the source of sanitation water for public toilets at the Sunan Ampel Surabaya Tourist Site. Various inorganic and organic substances contained in well water create an ideal environment for the growth and development of microorganisms. Water used for sanitation purposes must be free from pathogenic microorganism contamination, such as fungi. Fungi can become a source of contaminants in water [19]. Microorganisms such as mold present in water can be toxic, pathogenic, and allergenic [20]. Mold has been identified as a major factor in water pollution due to its ability to survive in the environment. Reports show that mold is a pollutant and contaminant in various types of water [25].

Public restroom facilities are provided for visitors to tourist attractions, leading to a diverse and constantly changing group of users. As a result, public restrooms can become a medium for the spread of disease [26]. Mold can grow and develop in public toilets that are used communally. Laboratory examination results show that the women's toilet tanks have more mold than the men's toilet tanks. According to research [27], the more people use a toilet, the greater the likelihood of mold contamination in the toilet tank. The presence of mold in the toilet tank can be due to a lack of hygiene and sanitation in the tourist site environment, which is directly proportional to the frequency of public toilet use at the site [15]. This is consistent with the statement [18] that communal toilet use can affect the condition of the toilet, leading to poor maintenance of cleanliness. This happens because not all toilet users have good hygiene habits. Poor hygiene behavior of toilet users can negatively impact the sanitary condition of the toilet [27]. Therefore, this research can be used as information related to the efforts of toilet sanitation facilities at Sunan Ampel Tourism in Surabaya and the importance of maintaining toilet sanitation to avoid health risks for visitors.

Various health problems that may arise from using unclean toilets often affect women more. The most common issues are skin infections and infections around the vaginal area. Using unclean public toilets can also lead to urinary tract infections. The main cause is the bacteria Escherichia coli, which is commonly found in toilets. Individuals with infections or certain illnesses can spread these through tissues, water, floors, and bathroom surfaces [28]. Diarrhea, typhoid fever, skin diseases, mycoses, and other illnesses can result from poor toilet sanitation. Inadequate toilet sanitation conditions allow bacteria, viruses, and other pathogens to proliferate and spread easily, increasing the risk of infection for users of these facilities. Proper prevention and maintenance of sanitation facilities are crucial to safeguarding health and preventing disease outbreaks that can endanger the community.

V. CONCLUSION

This research aims to describe the toilet cleaning process and the presence of mold in public toilet basins. Based on the research results and discussion, it can be concluded that temperature and humidity factors, clean water quality, visitor frequency, and the toilet cleaning process can influence fungal growth in toilet tanks. A more effective cleaning process can prevent fungal growth and reduce health risks and infections for cleaning staff and public toilet visitors. It is recommended that the tourist site management improve and enhance the toilet management system and sanitation conditions to prevent the toilets from becoming a source of disease transmission for visitors. Additionally, it is hoped that this research will be beneficial for future researchers by providing data on the number of fungal colonies and adding details about the specific types of fungi.

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