Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Investigation)

(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number:

Project Title: Be ware what you wear

Project Type: Investigation

***To our best knowledge, there <u>are / ~~are no~~</u> * similar works in the field*; (if there are,) related research links are as below:**

Takasshima, M. (2004). Distinctive bacteria-binding property of cloth materials. Vol. 32 No.1, 4. https://www.sciencedirect.com/science/article/abs/pii/S0196655303007O2
1. Allen, G. (2004, August). Bacteria bound to cloth. Evidence for practice, Vol 80 No. 2, 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7095187/

The enhancement our project made / the difference with related research are:

The data in the related research are too scientific to the general public——Majority of consumers will not even know much about the cloth materials they are wearing daily, not to mention how those cloth perform in the aspect of bacterial-binding (e.g. what is T-shirts made of and how it performs when in contact with bacteria). Those researchers also failed to simulate real-life situations and just hastily carried out the experiments by immersing cloth fibres into bacterial suspension, making the result somehow not valid enough. In addition, as a group of students, we are driven to wear school uniforms which can act as a source of infection transmission and hence lead to some potential health risks especially when the uniforms are of poor quality. Unfortunately, few attempts have been made to show concern on those issues discussed above. It is therefore hoped to find out the quality of our school uniforms against bacteria through a series of relatively simple experiments with the consideration of real-life simulation.

Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.

I. Background

In this day and age, awareness on hygiene is highly emphasised among citizens. While many of us have realised cleaning our hands and belongings, invisible culprits could be hiding everywhere. Perhaps people are more aware of contacting objects in order to reduce the risk of bacteria infection. However, clothes are ordinary in our daily lives while they can be contaminated easily by bacteria from the environment, which threaten our health. Therefore, we would like to investigate which textile is most unfavourable for bacteria growth to improve the protection of our body health. Due to limitations, school uniforms are used for the following reasons: the research is closely connected with us; and for another reason, this acts as an indicator to reflect and remind students about student's living habits. From the previous research mentioned above, it has been widely concluded that cotton and nylon excel at isolating bacteria from itself while wool, acrylic and polyester are good carriers of bacteria and are therefore not recommended to be used in regions with poor hygiene conditions.

II. Objectives

1. Find out the quality of our school uniforms against pathogens
2. Show concern on students‘ health and urge the school to make improvements on school uniforms

III. Hypothesis

No hypothesis is needed for this experiment.

IV. Methodology

Experiment 1: Impact on growth of bacteria among various clothings
Investigation on the bacteria growth on different types of textiles in school uniform
Objective: Investigate the effect of bacteria growth on different types of textiles when we study at school and on the way back home.
Apparatus:
School uniform, PE uniform, PE jacket, Coat, Sweater, 70% alcohol, Auto pipette, Cotton swabs, Nutrition bloth, Bunsen burner, Petri dishes with culture medium agar, Spreader, Incubator
Procedure:
1. An area of dimension 5cm X 5cm on the cloth around the chest is marked as the experimental area
2. The types of clothes are worn by 10 participants. Participants are selected by choosing people with similar classrooms to move at school to minimise individual fluctuations. Two participants form a group and each group is assigned to work on one specific type of cloth to be tested by them.
3. At the beginning of the experiment, the experimental area should be sterilized completely at school. Immediately, samples of bacteria in the experimental area before the experiment started should be collected for a fair comparison. Standard procedure to collect bacteria sample are carried out and bacteria are cultured for 72 hours.
4. Clothes should then be put on to the participants with the experimental area being completely exposed to air for contamination.
5. Bacteria samples are expected to be collected at school and on the way from school to home. Participant are required to wear the corresponding type of cloth throughout school time and on the way home. Clothes are not worn at home by the participants and should be placed in an open space.

6. Clothes are worn for 3 days successively while having ordinary school lives. At the end of the third day at school, bacteria samples in the experimental area are again collected for comparison. The bacteria are collected in the same method described
in step i to viii. Experiment 2: Impact on growth of bacteria among various clothings between distinct positions Investigation on the bacteria growth on different types of textiles in school uniform on chest and sleeve without masks Objective: Investigate the effect of bacteria growth on different types of textiles when we study at school and on the way back home when people take off their masks.
Apparatus: Same as Experiment 1
Procedure:
1. An area of dimension 5cm X 5cm on the cloth around the chest and the sleeve is marked as the experimental area
2. Steps 2-6 in Experiment 1 are repeated with the same participants for fair comparison.
3. Possible difference in bacteria amount is observed between the two experiments

V. Results

Clothes tested	Student	Number of bacteria colonies after being sterilised on 15/2 (count on 17/2)	Density of bacteria in 2ml solution	Avg.	Number of bacteria colonies collected on 17/2 (count on 21/2)	Density of bacteria in 2mL solution	Avg.	Average change in bacteria colonies density
School uniform	A	0	0	0	14	280	250	250
	B	0	0		11	220		
PE uniform	C	0	0	0	4	80	40	40
	D	0	0		0	0		
PE jacket	E	0	0	0	25	500	270	270
	F	0	0		2	40		
Sweater	G	0	0	0	29	580	320	320
	H	0	0		3	60		
Coat	I	0	0	0	5	100	90	90
	J	0	0		4	80		

Clothes tested	Student		Number of bacterial colonies collected on 3/3 (count on 7/3)	Number of fungus colonies collected on 3/3 (count on 7/3)	Density of bacteria and fungus in 2mL solution	Average density (Sleeve)	Average density (Chest)
School uniform	A	Chest	8	2	200	220	220
		Sleeve	5	0	100		
	B	Chest	12	0	240		
		Sleeve	6	11	340		
PE uniform	C	Chest	4	3	140	80	110
		Sleeve	4	0	80		
	D	Chest	4	0	80		
		Sleeve	4	0	80		
PE jacket	E	Chest	*	0	80	40	*
		Sleeve	2	0	40		
	F	Chest	1	4	100		
		Sleeve	2	0	40		
Sweater	G	Chest	36	0	720	180	460
		Sleeve	1	0	20		
	I	Chest	10	0	200		
		Sleeve	17	0	340		
Coat	J	Chest	3	0	60	30	40
		Sleeve	2	0	40		
	K	Chest	1	0	20		
		Sleeve	1	0	20		
Control setup (exposed in air for 20s)			0	0	0	0	0

By comparing the data of the two experiments, we can observe that PE uniform has the overall least average increase of fungus and bacteria colonies, which states that it is not favourable for bacterial growth. Besides, we can observe that sweaters have the greatest average increase of fungus and bacteria colonies, which states that it is favourable for bacterial growth. Also, in experiment 2, we can notice that the total number of bacteria colonies when people can take off their mask is similar to that of experiment 1, which means that wearing a mask possibly cannot prevent the spread of bacteria.

Source of errors

1. Contamination during the collection of bacteria
2. Individual differences such as personal habits, travelling time from school to home.
3. Location of bacteria

Direction for further investigation:

We suggested that for further investigation, more participants should be invited to reduce the individual fluctuations and they should have similar habits and living district. Also, further investigation on what chemical/substance can best prevent the bacteria growth on different kind on textile can be conducted so that we can find out the best way to enhance the ability of cloth against bacteria by reducing the amount of bacteria of a certain kind of textile (e.g. school jacket) after acknowledging that it is favourable to the growth of bacteria in order to improve the protection of our body health which matches our objective.

VI. Conclusion

Concluding the results, we found that PE uniform and coat are not favourable for bacterial growth as they contain the least number of bacteria, having a density of less than 100. While school uniforms and sweaters are rather favourable for bacterial growth, varying within the range of density 200 to 400 bacteria. Although no conclusion can be made for PE jackets for Experiment 2, we can observe similar results compared to school uniforms and sweaters. This also illustrates the fact that students should pay more attention to hygiene concerns while wearing the above clothes, especially their chest.

☐ **Our project is developed based on previous project and the enhancement is below:**

N/A