

A Survey and Analysis of the Hygienic Aspects of Pet-Dog Clothes Materials

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Abstract

The purpose of this research is to reveal the antimicrobial activity of pet-dog clothes by investigating the bacteria resistance of 4 kinds of pet-dog clothes materials.

1. Investigation Results of Pet-Dog Clothes

64.7% of 150 survey participants, revealed they had pet-dog clothes. Hand laundering was 67.0%, while the laundering of both human and animal clothes was 9.2%. The greatest washing frequency was once every 2 weeks. So, the subjects didn't seem to think high of hygienic matters.

Even though no if any relations were reported by 34.7% of the subjects, there were some experiences like sneezing or coughing (41.3%), slight itching (20.7%), and acute skin allergies.

There were such hugging methods as heart to heart to the center (22.7%), face to face and around the mouth (16.7%), and below the heart with the dog's face outward (15.3%). Thus, hugging the dog near the pet-lover's face seems to be the cause of respiratory diseases including sneezes and coughs.

2. Results of the Anti-Bacteria Experiment of Pet-Dog Clothes Materials

According to the analysis of the germs collected and cultured in this study to reveal the properness of pet-dog clothes materials, they were bacteria or bacilli in shapes.

Spore growth was active in the order of such experimental materials as artificial leather > cotton > cotton/ nylon > polyester (finest thread).

In terms of germ groups, the order was polyester(finest thread) > cotton > cotton/ nylon > artificial leather.

Key words: pet-dog clothes, bacilli, bacteria-resistance experiment, respiratory disease, finest thread

I. Introduction

Because of the increase of nuclear families and singles recently, there is a great tendency of considering a pet as a family member. According to the Korea Pet Dog Society, the population of

pet dogs in Korea has been reached 3 millions at the end of 2002¹⁾.

The increasing puppy-loving population resulted in the boom of various businesses, such as pet furniture, pet broadcasting, pet insurance, pet bathhouses, and pet taxis.

The growing number of dog lovers and the expansion of the related industries have finally created a new area of pet-dog clothes. Now clothes are no longer for human beings only. The pet-dog clothes for sale include T-shirts, trench coats, one-piece dresses, etc. A variety of designs, materials, and applications of pet-dog clothes has been developed.

At present, pet dog's costume is aesthetically chosen according to the tastes of dog fanciers. The aspects of health and hygiene for the dogs and people are rarely considered. As a result, we have seen some cases of damages like bronchitis and skin allergies resulting from the pet dog's hair²⁾.

According to the Korea Consumer Protection Board, 157 pet accidents have been reported to the information collection system since 20012). In particular, 53 cases (34% among them) occurred this year up to May. Biting or scratching by pets was most common, followed by skin diseases and parasite infection.

In case of indoor house pets, some special care must be taken in the sanitary control of pet dogs and their skin diseases. That's why the concrete research into the physiological and hygienic aspects of pet-dog clothes is thought necessary.

Therefore, this research first holds the actual investigation of pet-dog clothes to consider their influence on pet dogs and dog owners. Then, through the bacteria-resistance experiments, the characteristics of the germs are examined.

In the second study, we are going to research the microbiological influence on the human body.

II. Research Methods & Procedure

1. Investigation of Pet-Dog Clothes

1) Subjects & Period

150 pet dog owner-lovers were the subjects for this study and participated in a preliminary survey from April 29 to May 22, 2003.

2) Methods & Contents

The questionnaire used in this research went through reliability analysis (Cronbach's alpha 0.60). The contents of the questionnaire are shown in Table 1.

<Table 1> Questionnaire items

Contents	Items
Demographic characteristics of the subjects	8
Pet dog-related things	6
Pet lovers' pet-dog clothes	8
Maintenance of pet-dog clothes	7
Relations of the pet and the pet owner	7
How to take care of the pet dog	4
Total	40

3) Data Processing

With the SPSS/win (ver 10.0), each item's frequency was calculated.

2. Bacteria-Resistance Experiment of Pet-Dog Clothes Materials

1) Experiment Date & Place

The experiment was conducted at the Microorganism Analysis Laboratory belonging to the Food Science Division of Dong-A University

<Table 2> Characteristics of the dog used in experiment

Species	Weight	Hair Length	Medical Checkup	Residence	Sex	Age
Shihtzu	3.2kg	2.5cm	1/ Three Months	Indoors	F	1 year

<Table 3> Characteristics of Pet-Dog clothes materials

Materials	Anti-Bacteria Processing	Textile Composition (%)	Density	Structure	Weight (g/m ²)
A (Cotton)	×	Cotton 100%	102 × 102	Knitting	272.5
B (Cotton/Nylon)	×	Cotton 35%, Nylon 65%	144 × 183	Twill	397.5
C (polyester.finest Thread)	○	Polyester 100%	169 × 220	Shuttle	280.0
D (Artificial Leather)	×	Polyester 100%	.	.	495.0

from July 30 through August 18, 2003.

2) Experiment Pet

For the purpose of collecting bacteria, pet parasites, the favorite dog species by the pet fanciers was chosen. After the examination by vets, one healthy dog was finally selected as an experimental subject. Its characteristics are shown in Table 2.

3) Test Cloth Selection

The test cloths used in the experiment were those sold in the market, while their textile composition percentage was analyzed through the KSK 0210 8.2 by the Korea Clothes Test Institute in Busan.

4) Experimental Methods

(1) Reagent & Equipment

Cell suspension fluid was used as the reagent, and PCA (Plant Count Agar) acted as a culture fluid. The instruments were the clean bench (MM-80 Manometer, Dwyer Instruments, INC), the incubator (DYS 2935), the vortex mixer (KMC-1300V), petri dishes, and electronic microscopes

(OLYMPUS, EHS 204752).

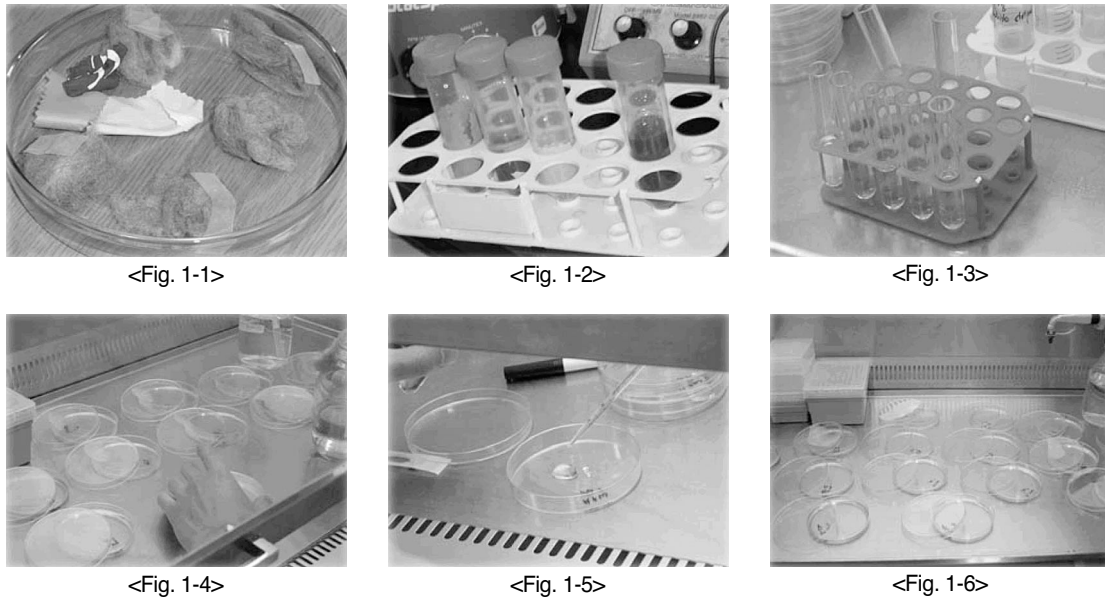
(2) Experimental Order

a) Collection of Dog Hair

70g of dog hair was collected by combing the dog for 5 days in order to gather the bacteria residing in the dog's hair.

b) Bacteria Culture on Test Cloth

- ① Dog hair (70g) is put on each test cloth (3.5cm × 4cm) for 120 hours (Fig. 1-1).
- ② Test cloths are immersed in 4 test tubes containing 20ml of distilled water within the clean bench. The test tubes are well mixed in the vortex mixer. The germs are separated from the cloths in this process and diluted in the distilled water. The cloths are then picked up (Fig. 1-2).
- ③ The bacteria in the diluted fluid are checked by the microscope at the enlargement ratios of 200 and 400 times. The fluid is diluted again to make test solutions (10¹, 10³) as shown in Fig. 1-3.
- ④ The germ-diluted fluid (0.5ml) and the cell suspension fluid (4.5ml), acting to help bacteria stop getting divided, were blended



<Fig. 1> Processes of bacteria extraction and culture

by the vortex mixer.

- ⑤ 1ml each of 8 test tubes (4 test cloths × 2 kinds of diluted fluids) was moved to 8 petri dishes. PCA was applied, and each fluid was cultured for 48 hours at the 37°C incubator.

c) Bacteria Measurement Methods

Each cloth's conditions of bacteria spore growth were checked and measured by the Kirby-Bauer Disk Method as seen in Table 4.

Table 4. Bacteria spore growth conditions

Division	Definition
-	No spore growth
+	Spore growth (diameter: ≤ 0.3cm)
++	Spore growth (diameter: 0.5cm ± 0.2cm)
+++	Spore growth (diameter: 1.0cm ± 0.2cm)
++++	Spore growth (diameter: 1.5cm ± 0.2cm)
+++++	Spore growth (diameter: ≥ 1.8cm)

III. Results & Discussion

1. Investigation Results of Pet-Dog Clothes

1) Demographic Characteristics of the Subjects

Women were 74% and men were 36%, while singles were 63.6% and married people were 36.4%. Those in their 20s were 59.3%, and college graduates were 65.3%. Nuclear families were 69.3%, no-kid families 14.7%, and large families 7.3%.

2) Pet-Related Things

Pets owned by the subjects were as follows: shihtzu (21.3%) > maltese (14%) >Yorkshire terrier (14%) >poodle (10.7%). There were more females (56.7%). Pets were less than 1 year old (26.7%) or 1~2 years old (30%). 31.4% weighed 2~4kg. The body length was 30~50cm (46.7%), and the height was 20~40cm (46.7%). Hair

length was 1~3cm (30.7%), 3~5cm (26.7%), and below 1cm (20.7%). Most importantly, 64.7% of the survey participants used pet-dog clothes < Table 5>.

3) Pet Dog's Clothes-Related Things

Among 150 investigation answerers, 97 who had pet-dog clothes answered the questionnaire. Their favorite items (among pet-dog clothes) were in the order of T-shirts (62.9%), one-piece dresses(23.7%), pants(3.1%). The pet-dog clothes were mostly worn in winter (63.9%), probably for the purpose of keeping warmth, and regardless of seasons (32%). The frequency of clothes wearing was 1~2 times a week (46.3%), 3~4 times a week (27.7%), and all the time (12.7%).

About 69% of the subjects seemed to give no special consideration to the materials at the time of purchasing pet-dog clothes. 83.5% said they usually considered nothing about materials, 13.4% preferred natural materials, and 3.1% loved synthetic materials.

In the case of pet-dog clothes made of synthetic materials, the experience of static electricity owing to the low humidity in winter was reported. Some subjects also talked about allergic diseases in the pet's front legs due to improper patterns and materials. In sum, though no special concern was shown about clothing materials, a few problems about unsuitable materials were pointed out.

4) Maintenance of Pet-Dog Clothes

97 subjects revealed their laundering and maintaining methods of pet-dog clothes as seen in Table 6. Hand laundering was 67.0%, followed by the washing of pet-dog clothes only (11.3%) and the laundering of human and animal clothes

<Table 5> Pet-Related Things

Contents	Investigation Items	Frequency	
		N	%
Species	shihtzu	32	21.3
	maltese	21	14.0
	Yorkshire terrier	21	14.0
	poodle	16	10.7
	Etc.	60	40.0
Sex	female	85	56.7
	male	65	43.3
Age	less than 1 year	40	26.7
	1~less than 2 years	45	30.0
	2~less than 3 years	27	18.0
	3~less than 5years	16	10.7
	5years or more	21	14.6
Weight	less than 2kg	25	16.7
	2~less than 4kg	48	31.4
	4~less than 6kg	32	21.3
	6 or more	21	14.6
	Etc.	24	16.0
Body Length	less than 30cm	14	9.3
	30~less than 50cm	70	46.7
	50~less than 70cm	21	14.0
	70cm or more	7	4.7
	Etc.	38	25.3
Height	less than 20cm	16	10.7
	20~less than 40cm	70	46.7
	40~less than 60cm	6	3.9
	60cm or more	7	4.7
	Etc.	51	34.0
Hair length	less than 1cm	31	20.7
	1~less than 3cm	46	30.7
	3~less than 5cm	40	26.7
	5~less than 10cm	23	15.3
	10cm or more	8	5.3
Pet-dog clothes	Used pet-dog clothes	97	64.7
	Not used pet-dog clothes	53	35.3
Total		150	100.0

(9.2%). The washing frequency was once every 2 weeks (34.0%), 2~3 times a week (27.8%), and

<Table 6> Maintenance of pet-dog clothes

Contents	Investigation Items	Frequency	
		N	%
Washing Methods	Hand laundering	65	67.0
	Pet-dog clothes only in the washing machine	11	11.3
	Laundering with the owner's clothes	9	9.2
	Boiling laundering	5	5.2
	Dry cleaning	7	7.3
	Total	97	100.0
Washing Frequency	2~3 times a week	27	27.8
	Once every 2 weeks	33	34.0
	Once a month	22	22.7
	Once every 3 months	6	6.2
	No washing at all	9	9.3
	Total	97	100.0
Problems after Washing	Nap	40	41.4
	Loose texture and seams	25	25.6
	Size change	19	19.6
	Discoloration & decoloration	13	13.4
	Total	97	100.0
Storage Methods	Pet-dog clothes only	83	85.6
	With the owner's clothes	7	7.2
	Etc.	7	7.2
	Total	97	100.0

once a month (22.7%).

In case of after-washing problems, nap occurrence took the greatest percentage of 41.4%, followed by loose texture and seams (25.6%), size change (19.6%), and discoloring and decoloring (13.4%). Therefore, the quality improvement of pet-dog clothes seems to be required. In case of Storage methods, 85.6% preferred to keep pet-dog clothes only, while 7.2% liked to take care of the dog's and the dog owner's clothes together.

5) Pet Influence on Its Owner

The diseases infected to the owner by the pet are shown in Table 7.

<Table 7> Health conditions of the pet owner owing to the pet

Contents	Investigation Items	Frequency	
		N	%
Pet Owner's Disease	Sneezes or coughs	60	41.3
	No relations with the pet dog	52	34.7
	Light itches	31	20.7
	Acute skin allergies	5	3.3
	Total	150	100.0
Number of Visits to the Doctor's Owing to the Disease	1~2 times	23	40.3
	3~4 times	20	35.0
	5~6 times	9	15.8
	7~8 times	3	5.4
	9 times or more	2	3.5
Total	57	100.0	

Sneezing or coughing (41.3%) was the highest, while no relations (34.7%), slight itching (20.7%), and some skin allergies (3.3%) were followed. Therefore, 65.3% of the subjects was suffered from some kinds of illness. Clinic visits were in the order of 1~2 (40.3%), 3~4 (35.0%), 5~6, 7~8, and 9 or more.

6) Pet-Loving Methods

Table 8 summarizes the pet-loving methods of the subjects.

The order of contacting hours with the pet dog was 2~4 hours (27.3%), 5~7 hours (22.0%), and below 1 hour. There were such hugging methods as heart to heart (22.7%), face to face and near the mouth (16.7%), and to the heart with the dog's face outward (15.3%). Thus, hugging the puppy close to the pet-lover's face seems to have caused such diseases surveyed in Table 6.

<Table 8> Pet-loving methods

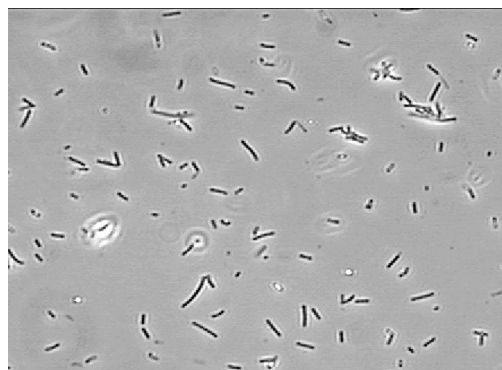
Contents	Investigation Items	Frequency	
		N	%
Contact Hours the Pet Dog	Less than 1 hour	31	20.7
	2~4 hours	41	27.3
	5~7 hours	33	22.0
	8~10 hours	25	16.7
	11 hours or more	20	13.0
	Total	150	100.0
Hugging Methods	Heart to heart	34	22.7
	By the neck	15	10.0
	Face to face and close to the mouth	25	16.7
	To the heart with the dog's face outward	23	15.3
	Etc.	53	67.3
	Total	150	100.0
Rearing Period	Less than 6 months	23	15.3
	1~2 years	57	38.0
	2~3 years	21	14.0
	3~5 years	13	8.7
	5~7 years	10	6.7
	7 years or more	26	17.3
Total	150	100.0	

As to the period of rearing the pet dog, the order was 1~2 years (38.0%), 7 or more years (16.0%), below a half year (15.3%), and 2~3 years (14.0%). This proves the growth of pet-dog-rearing population in recent years.

2. Results of the Anti-Bacteria Experiment of Pet-Dog Clothes Materials

1) Bacteria's Shapes and Characteristics

Fig. 2 shows the shapes of bacteria collected from the pet dog. The germs were like bars or cylinders with diverse length and sizes. Also, their both ends were not constant, while the germs



<Fig. 2> Shapes of bacteria collected from the pet dog(microscope 200×)

were widely spread.

These bacteria or bacilli are rather resistant to outer influences, so they can survive in some disadvantageous conditions. Sprouting in certain proper surroundings, they grow to adult germs. Similar kinds of germs are diphtheria, tuberculosis, and tetanus.

2) Results of Bacteria's Spore Growth

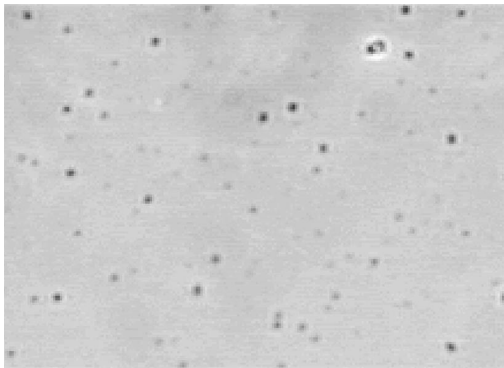
Table 9 shows the results of bacteria's spore growth.

The experimental materials showed spore growth in the order of D > A and B > C. The ranges of spore development were different from material to material: D (1.5cm ± 0.2cm), A and B (1.0cm ± 0.2cm), and C (0.5cm ± 0.2cm).

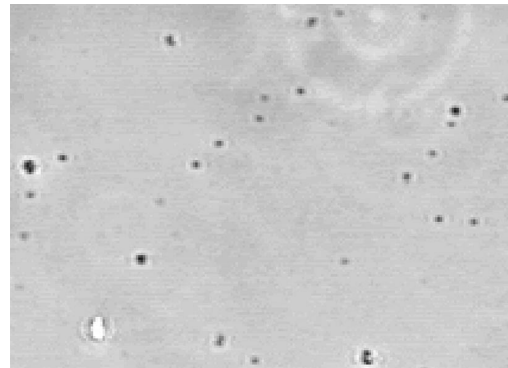
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<Table 9> Results of bacteria's spore growth

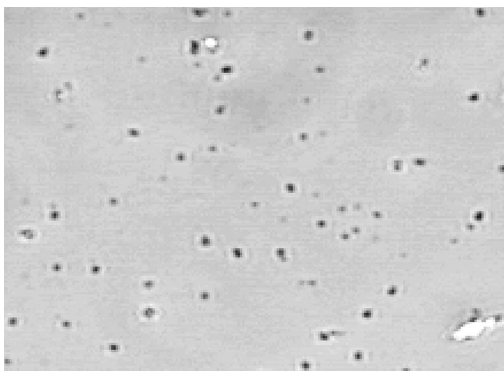
Materials	Dilution Ratios	
	1 × 10 ¹	1 × 10 ³
A (Cotton)	+++	+++
B (Cotton/ Nylon)	+++	+++
C (polyester:finest Thread)	++	++
D (Artificial Leather)	++++	++++



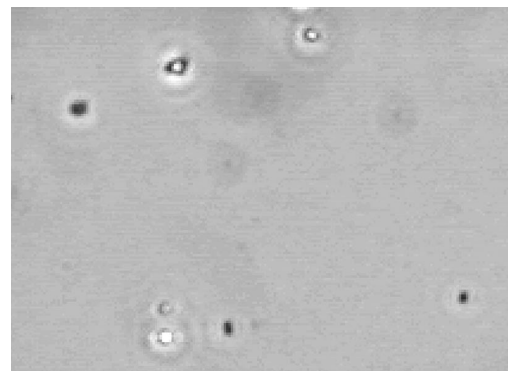
<Fig. 3-1> Cotton



<Fig. 3-2> Cotton/ Nylon



<Fig. 3-3> Finest Thread



<Fig. 3-4> Artificial Leather

<Fig. 3> Microscope photographs of germ groups according to experimental materials

better environment for spores, it is least resistant to germs. So, Material C can resist bacteria best. Its finest thread material can check germ reproduction better than other materials. With excellent absorbance, C is thought to prevent and destroy the occurrence of bacteria or mold.

3) Observation of Germ Groups

The conditions of germ groups (microscope: 200 times) are revealed in Fig. 3.

In the order of $C > A > B > D$, bacteria were observed. This is because Material C (169×220 /inch) has higher textile density than Material A (102×102 /inch) or Material B (144×183 /inch).

Henceforth, even though the greatest germs were observed in Material C, the least spore growth was recorded. Owing to the increasing number of bacteria, the least space for spore growth would hinder or lower the possibility of spore spread. On the contrary, in three other materials, Material D had the biggest spore growth.

IV. Conclusion

With 150 pet lovers residing in Busan, this research that held the actual investigation of pet-

dog clothes and, through the bacteria-resistance experiment with 4 kinds of experimental materials of pet-dog clothes, attained the following conclusion.

1. Investigation Results of Pet-Dog Clothes

1) 64.7%, or 97 out of 150 survey participants, revealed they had pet-dog clothes. Their favorite pet-dog clothes item was in the order of T-shirts, one-piece dresses, pants, and coats.

2) In most cases, pet-dog clothes were worn during the winter season, perhaps to keep warmth. About 69% of the subjects gave no special consideration to the materials at the time of purchasing pet-dog clothes.

3) Hand laundering was 67.0%, while the laundering of both human and animal clothes was 9.2%. The greatest washing frequency was once every 2 weeks. Therefore, most pet-dog owners didn't seem to mind the hygienic aspects of pet-dog clothes.

4) Even though no if any relations were reported by 34.7% of the subjects, there were some experiences like sneezing or coughing (41.3%), slight itching (20.7%), and acute skin allergies.

5) The order of contact hours with the pet dog was 2~4 hours (27.3%), 5~7 hours (22.0%), and below 1 hour (20.7%), and 8~10 hours (16.7%). There were such hugging methods as heart to heart to the center (22.7%), face to face and around the mouth (16.7%), and below the heart with the dog's face outward (15.3%). Thus, hugging the puppy near the pet-lover's face seems to be the cause of respiratory diseases including sneezes and coughs.

2. Results of the Anti-Bacteria Experiment of Pet-Dog Clothing Materials

1) According to the analysis of the germs collected and cultured in this study to reveal the properness of pet-dog clothes materials, they were bacteria or bacilli in shapes.

2) Spore growth was active in the order of such experimental materials as artificial leather > cotton > cotton/ nylon > finest thread.

3) In terms of germ groups, the order was finest thread > cotton > cotton/ nylon > artificial leather.

In sum, washing and keeping the clothes of the pet dog and its owner are problematic in hygienic and epidemic matters. In addition, as 65.3% suffered from some kinds of diseases like skin sickness, sneezing, and coughing, the pet dog's hygiene needs to be checked without fail. Among the pet-dog clothes materials, finest thread was the best in checking germ multiplication. So, the use of the hygienically-processed material is highly recommended in the clothes of both human beings and pet dogs.

3. Suggestions

1) The recent growth in the number of pet-loving population has brought about some cases of diseases or damages owing to the careless maintenance of pet dogs. Most pet dog lovers use pet dog's clothes for the sake of aesthetics, hardly considering hygienic issues. Therefore, sanitary laundering and storage methods are required. Also, sincere consideration should be given to the selection of pet clothes in their materials in order to protect the health of the dog and its owner.

2) Thanks to the boom of the pet-related industry, various kinds of pet-dog clothes are

available. But some clothes don't represent material contents or storage methods, which could mislead customers in handling pet-dog clothes. Thus, the development of pet-dog clothes with diverse functions and antimicrobial finishing would be demanded.

4. Research Restrictions

Though the present research revealed the germs here were bacilli, their correct characteristics and any influences on human body were not investigated. More detailed studies ought to be followed.

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