



## Research Article

### AN ATTEMPT TO ESTABLISH BACTERIA THAT HARBOURS ON KITCHEN CLOTHES IN INDIAN KITCHEN ENVIRONMENTS

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#### ABSTRACT

Cotton fabrics seem to be a very common material which is regularly used in conventional homes especially kitchen environments. These fabrics were used for multipurpose, as a result they get stain and usually these stains will be left unnoticed. Cotton fabric products in kitchen include dishcloth, wiping cloth, hand towels and tea towels. The most common fabrics used in kitchens are dishcloth and wiping cloth. The study we carried out use dishcloth, gives an alarming finding that these fabric acts as a carrier. Carrier is a term mostly used in microbiology and mostly related with microbial growth, states that transfer of bacteria from one surface to another surface. The fabric subjected to use in vegetarian and non-vegetarian Indian kitchen environments, supports the growth of bacteria/genus, namely *Pseudomonas aeruginosa*, *Pseudomonas fluorescens*, *Bacillus species*, *Enterococcus species* and *Streptococcus species*. These fabrics that harbours above said bacteria can be a role playing factor in health issues, if it has not been given important attention. Health care and hygiene is an increasing demand in every possible area and a suitable remedial measure should be incorporated in the cotton fabric itself to suppress these bacterial growths.

**Keywords:** Bacteria, Kitchen, Cotton, Carrier, Homes

#### INTRODUCTION

Microorganisms can be found almost everywhere in the environment. Cotton textiles in contact with the human body offer an ideal environment for microbial growth. Bacteria both pathogenic and odour causing, interact with fibres in several phases including the initial adherence, subsequent growth and damage to the fibres and dissemination from them<sup>1</sup>.

A dishcloth which is used for drying dishes, pots and pans and kitchen implements have more chances of contamination than other type of kitchen fabrics, namely wiping cloth, hand towel and tea towel. The severity of bacterial hazards caused by kitchen fabrics goes in the order of wiping cloth>dishcloth>hand towel>tea towel. Though the danger of bacterial hazards of wiping cloth is more than that of dishcloth, they have less probability to come in contact with food. Hence, care should be taken in the case of dishcloth, which has high probability to come in contact with food. Commercially, dishcloths subjected to antibacterial finish are not available and also so far attempts have not been taken to develop a suitable antibacterial finish for them.

Contamination of food products by microbial growth can cause potential health hazards to human beings. In recent years, much emphasis has been put on the safety aspects of food, since mass contamination is caused by food spoilage microorganisms<sup>2</sup>. Kitchen fabrics which are used in hotels, canteens in colleges and schools and home kitchens may act as one of the source for these contaminations. Studies conducted at South Africa, USA,

UK, Saudi Arabia, Turkey and Netherlands on kitchen fabrics proved that these fabrics harbour bacteria, namely *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Streptococcus faecalis*, *Staphylococcus epidermis*, *Bacillus cereus*, *Bacillus subtilis*, *Salmonella species*, *Shigella species*, *Clostridium perfringens*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Enterobacter cloacae*, *Listeria species* and *Campylobacter jejuni* due to two aspects, namely wetness<sup>3-11</sup> and improper washing after use<sup>10,12</sup>. No such attempt was made in India and hence information pertaining to presence of bacteria on fabrics used in Indian kitchen environments is not available.

An attempt has been made in this study to identify the bacteria that grow in dishcloths used in vegetarian and non-vegetarian Indian kitchen environments where prior information and instructions given to the house wives involved in this study on usage of the cotton fabrics (dishcloths) to be used in kitchens exclusively for the study purpose.

#### MATERIALS AND METHODS

##### Materials

Commercial grade 100% cotton terry pile dishcloth (220 gm<sup>-2</sup>) was used for growth of bacteria in kitchen environments and their subsequent identification. Analytical reagents (AR) sodium chloride, potassium chloride, calcium chloride and sodium hydrogen carbonate, and laboratory reagent (LR) neutral soap solution (Labolene) from Fisher Scientific India Pvt. Ltd., India., ethanol (AR) from Changshu Yangyuan Chemical, China and citric acid (LR) from Qualigens Fine Chemicals, India were

used. Crystal violet, gram's iodine and safranin solutions, and nutrient broth, nutrient agar were supplied by Sisco Research Laboratories, India. *Pseudomonas* isolation agar, blood agar, Manittol salt agar and Mueller Hinton agar were supplied by HiMedia Laboratories Pvt. Ltd., India.

### Sample Preparation

Dishcloths were given a pretreatment using soap solution (10 g/l) at 90°C with liquor to material ratio (l:m) 50:1 for 90 min followed by hot and cold washes, five times each, and dried at ambient conditions. These were distributed to thirteen Indian home kitchens, of which 9 were all time vegetarian and the rest were all time non-vegetarian kitchens. The house wives using the kitchens were instructed to follow the steps given below in using the dishcloth: a) to wash the utensils only with standard detergent, b) to keep the washed utensils in an inverted position to bring down the water content present in them, c) to wipe these utensils using the dishcloth supplied to them, d) to dry the dishcloth under shade after every use, e) to use the dishcloth for 1 to 5 days without subjecting it to washing.

### Identification of Type of Bacteria

The used dishcloths from all the houses were collected and tested for the presence and type of bacteria. 20 ml of prepared Quarter - Strength Ringer solution (Dept. of Health & Social Security, Washington, America, 1937) was taken in a conical flask and 25 cm<sup>2</sup> dishcloth samples were introduced in it. The flask was cotton plugged and incubated at 37°C in an orbital shaker for 30 min at 120 rpm. The solution so obtained was used for isolation of bacterial colonies by using serial dilution and spread plate techniques. Upto 10<sup>-7</sup> dilutions were used in serial dilution procedure in order to obtain various bacterial colonies separately in the solution. The bacterial colonies present in the solutions were separated using spread plate technique. The individual bacterial colonies obtained were removed using inoculating loop and cultured separately in a 25ml prepared liquid nutrient medium overnight at 37°C in an orbital shaker at 120 rpm to identify the classification (gram positive/gram negative) and type of bacterium following the standard procedure<sup>13</sup>. *Pseudomonas* confirmatory test was carried out for colonies which exhibited green colour and classified as gram negative bacterium whereas, blood agar and Manittol salt agar tests were carried out for colonies, which exhibited white colour and classified as gram positive bacterium.



Figure 1: Colony morphology on petri plates by initial serial plate dilution technique



Figure 2: Quadrant streak / continuous streak obtained on petri plates

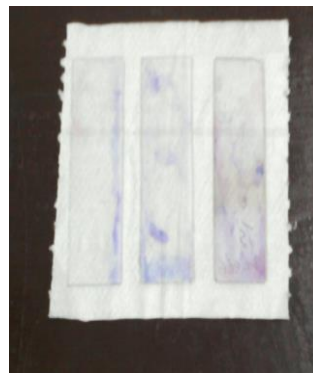


Figure 3: Confirmatory tests carried for identified colonies using gram staining tests

## RESULTS AND DISCUSSION

### Types of Bacteria Isolated

The samples collected from a time span of 1-5 days from each home kitchens were evaluated initially for different colonies. All the 5 days sample from each vegetarian kitchen environments were found to have same 5 different morphological colonies and similarly one colony were found from each non-vegetarian kitchen environment too on all the 5 days sample. Based on the morphology and colour, four bacterial colonies were identified in the diluted solutions containing the extract from dishcloths used in the vegetarian kitchen environment and among these three were white in colour and one was green in colour whereas, with respect to non-vegetarian kitchen environment, only one colony, green in colour was identified. The complete absence of vegetarian environment bacteria in the non-vegetarian environment may be noted and it may be due to the practice of repeated washing of utensils, atleast twice, used for the preparation of non vegetarian food, which would have resulted in complete removal of residues of vegetarian food stuff.

In gram staining test, all the green colonies developed pink/red colour and hence, they were classified as gram negative bacteria. All the white colonies developed purple/blue colour and hence, they were classified as gram positive bacteria. The *Pseudomonas* confirmatory test carried out using incubated cultures produced from green bacterial colonies developed green as well as yellow colour pigments. Development of green pigments indicated the presence of *Pseudomonas aeruginosa* and the yellow pigments indicated the presence of *Pseudomonas fluorescens*. One of the white bacterial colonies shown colonial growth in the blood agar test and hence the genus was identified as *Bacillus species*. Out of the remaining two white bacterial colonies, one of the colonies developed colonial growth in the Manittol salt agar test. Hence, it was presumed that the genus could be either *Staphylococcus species* or *Enterococcus species*. Since the unique characteristics of *Staphylococcus species* could not be seen, the genus was decided as *Enterococcus species*. The last white colony which did not answer for Manittol salt agar test was decided to be *Streptococcus species* based on the observation of chain like arrangement in the gram staining test carried out. The identification of exact species in the various genus identified requires further studies to be carried out.

### CONCLUSION

*Pseudomonas aeruginosa*, *Bacillus species*, *Enterococcus species* and *Streptococcus species* were identified in the dishcloths used in vegetarian kitchen environment and *Pseudomonas fluorescens* alone was found in the case of non-vegetarian kitchen environment. 'Kitchen fabrics' are textile

materials used to keep kitchen environment clean from contamination caused by microbes such as bacteria, fungi and other parasites. But the result show, along with cleaning process these fabrics assist bacteria to grow on them. The primary reason for this may be chemical structure of cotton fabric which is cellulosic in nature that supplies nutrients to bacteria to have growth/multiplication on them. Hence vigorous cleaning needs to be done which is quite harsh for cotton fabric to survive, hence an alternate solution like antibacterial finished cotton might reduce the potential danger of growth of bacteria on fabric used on these kitchen environments.

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