A Study On Analysing Microorganism Growth In Various Materials Of Cooking Vessels

Dr.E.Muthu Kumaran, M.Navin Kumar, Dr.J.Deny, Dr.T.S.Arun Samuel

Abstract: Microorganisms are omnipresent, in food it can be beneficial as well as harmful based on their nature. The present study focused on analyzing the rate of microorganism growth on various materials of cooking vessels which inhibit the microbial growth on its surface. In many studies it is mentioned that various pathogenic bacteria like E. coli, Listeria monocytogenes, Campylobacter, Staphylococcus aureus and Salmonella spp., present in cooking vessels and surrounding materials in kitchen. The main objective of this study is to utilize the low cost paper based microscope to understand the nature of the material less susceptible to bacterial colonization. The work was carried out with eight different type of cooking vessels commonly used which includes Copper, Brass, Silver, earthen pot, glass, tin, plastic and stainless steel. The food starch stained with different chemical reagents and observed under the Foldscope to identify the growth of microorganism at different materials of the cooking vessels at different intervals. Out of all, vessel made of Brass was showing inhibition towards microbial growth till the 48 hours.

Keywords: Microorganism, food quality, cooking vessel, inhibit, Foldscope.

1. INTRODUCTION

Microbes are ubiquitous in nature and found everywhere including land, water and air. Microbes are important in human culture and health in many ways, serving to ferment foods, treat sewage, produce fuel, enzymes and other bioactive compounds. They are essential tools in biology as model organisms and have been put to use in various field. They are a vital component of fertile soils. In the human body microorganisms make up the human microbiota including the essential gut flora. They are the pathogens responsible for many infectious diseases and as such are the target of hygiene measures. Foldscope is an optical microscope formed by assembling the sheet of paper and a lens. It is the cheapest and easy tool to observe the biological and non--biological samples with the resolution of 2 microns and 140X magnification. The low cost foldscope was invented by Manu Prakash [1] at Stanford University, for reaching the microscope to all class of peoples. Figure 1 shows the image of the Foldscope. James et.al [2] has described the large scale manufacturing cost of the origami based paper microscope and its instrumentations. Ephraim et.al [3] have diagnosis’s the kind of infection using mobile phone microscope and it can used as global tool for health applications. In spite of being free of infection with E. coli, the dishes are comparatively high infection with heterotrophic bacteria and total coliform, this may be due to the lack of health compliance by kitchen staffs or inadequate washing and disinfection of dishes [4]. Many researchers [5-6] studied Foldscope and its application in the various fields of sciences. Contamination can also be passed from kitchen utensils or equipment when contacting food [7].

The cross-contamination in kitchens are due to sponges and dishcloths, since they can transfer microorganisms to surfaces where microorganisms can survive for hours or days and contaminate food persisting in these disease vehicles [8].

Figure 1. Paper Based Microscope - Foldscope

2. MATERIALS AND METHOD

2.1 Materials of Cooking Vessels

The research work was carried with eight different type of cooking vessels commonly used which includes Copper, Brass, Silver, earthen pot, glass, tin, plastic and stainless steel.

Figure 2. Different type of cooking vessels taken for study
Even kitchen sponges and dishcloths could lead to cross-contamination in kitchens since they can transfer microorganisms to surfaces where microorganisms can survive for hours or days and contaminate food persisting in these disease vehicles [6]. Diverse microorganisms including pathogenic microbes like Pseudomonas sp., Bacillus sp., and Streptococcus sp. were encountered in kitchen sponges [8]. Under favorable circumstances (temperature, pH, relative humidity), pathogenic microorganisms are able to survive and/or replicate in large scale [8]. Therefore the vessels were sterile and wrapped in the laboratory and stored in clean place.

2.2 Characterization of bacterial Cultures

2.2.1 Starch preparation
Starch of 1000 ml was prepared and sterilized. The sterilized starch solution was poured onto the vessels 100ml each and kept for incubation at room temperature 27°C. The prepared starch has been applied over all the cooking vessels at same humidity and temperature.

2.2.2 Agar preparation

2.2.2.1 Nutrient Agar
The Nutrient agar was prepared using sterile distilled water, with the composition of nutrient agar 14gm ; agar 2.5 gm, in 500ml of milli Q water. Spread plate on this media at different time interval and incubation for 24 hours. The presence and absence colonies on the media were observed. By this observation of microbial growth, the microbial growth inhibiting material cooking vessel is monitored.

2.2.2.2 Potato Dextrose Agar
The Potato Dextrose Agar was also prepared in sterile distilled water. The composition of PDA is PDA 19.5 gms, Agar 5gm in 500ml of milli Q water. Spread plate on this media at different time interval and incubation for 24 hours and observing the presence and absence colonies on the media. By this observation of fungal growth, the fungal growth inhibiting material cooking vessel is monitored.

2.2.3 Gram staining of bacteria
The slides were prepared by simple staining for selected colonies. On the basis of cell wall composition to differentiate the bacteria whether it belongs to Gram positive or Gram negative, Gram\'s staining was done [8].

2.2.4 Isolation and Characterization of microorganisms
Bacterial cultures were observed to find gram negative and gram positive bacteria by performing staining at various time intervals. The slide was placed in the paper based microscope interfaced with a mobile phone. After staining the cells were observed under foldscope and recorded the images for further analysis.

2.2.5 Sample Collection
The observations were recorded at regular interval of time at 6 hours, 12 hours, 18 hours, 24 hours, 32 hours and 48 hours samples from 9 different types of cooking vessels.

Figure 3. Slide Placed in the Paper based Microscope - Foldscope

Figure 4. Samples collected at various time intervals of the The collected samples were placed in the agar medium to

3. RESULTS AND DISCUSSION
From the respective agar plates the microorganisms are isolated from different materials of cooking vessels includes samples from copper, silver, stainless steel, fibre, plastic, brass, tin, mud and glass were given in Figure 5.
48 hours Nutrient Agar plates:

- Sample 1 (Copper)
- Sample 2 (Silver)
- Sample 3 (Stainless Steel)
- Sample 4 (Fibre)
- Sample 5 (Plastic)
- Sample 6 (Brass)
- Sample 7 (Tin)
- Sample 8 (Mud)
- Sample 9 (Glass)

The colony growth of the bacteria was captured through the paper based microscope “Foldscope”. Interfacing the simple microscope Foldscope with the mobile camera the images can be captured very clearly for the identification and estimation were given in Figure 6.

- Sample 1 (Microorganism growth in Copper observed under Foldscope)
- Sample 2 (Microorganism growth in Silver observed under Foldscope)
- Sample 3 (Microorganism growth in Stainless Steel observed under Foldscope)
- Sample 4 (Microorganism growth in Fibre observed under Foldscope)
- Sample 5 (Microorganism growth in Plastic observed under Foldscope)
- Sample 6 (Microorganism growth in Brass observed under Foldscope)
- Sample 7 (Microorganism growth in Tin observed under Foldscope)
Sample 8 (Microorganism growth in Mud observed under Foldscope)

Sample 9 (Microorganism growth in Glass observed under Foldscope)

4. CONCLUSION

Foldscope gives up to 140 x magnifications. It is durable, cost effective and easy to carry. Using Foldscope is very simple, the instrument is highly innovative and promising tool to explore science of our surroundings. It is very easy to interface Foldscope with the smart phone which assists in zooming, unlimited storage and clear image capturing including video recording. The experiment reveals that out of 9 different cooking vessels materials used in this study the microorganism growth in copper is very minimum even after it is used for long period of time i.e., for 48 hours. However, with higher resolution lens, the detailed study can be taken.

5. ACKNOWLEDGMENTS

The author is thankful to Department of Biotechnology (DBT) (under Ministry of Science and Technology, Government of India), for financial assistance through project under No. BT/IN/Indo-US-Foldscope/39/2015 Dated: 20.03.2018 and providing Foldscope received under the program “Proposals for the use of Foldscope as a research tool”. The author is also grateful to ANGOST, National Institute of Ocean Technology (NIOT), Port Blair for their moral and infrastructural support for completion of this project.

6. REFERENCES


