The Efficacy of Panfan Device at Trapping Airborne Microorganisms

Sophie Perigon and Cormac Murphy*, UCD School of Biomolecular and Biomedical Science, Ardmore House, Belfield, Dublin 4

Interim Report

A Project Conducted at University College Dublin and Funded under the Enterprise Ireland Innovation Partnership Programme

Summary

We report the initial findings on our studies to investigate the efficacy of the Panfan device at trapping microorganisms. A chamber onto which the Panfan device was connected, and which was located in a lavatory, was used to determine if the charcoal filter trapped airborne microorganisms. Our findings indicate that 99 % of airborne bacteria and fungi were trapped under the experimental conditions employed.

Introduction

The Panfan device, manufactured by Panfan International Ltd, is an odour removal system for lavatories, and is an alternative to chemical masking agents, which can be irritants. The device is designed to be installed directly on the overflow pipe in the cistern of the toilet, and comprises of a rechargeable battery-operated fan, which removes odours directly from the bowl, and a replaceable filter containing activated charcoal. A wall-mounted sensor automatically switches the fan on when the toilet is in use. The company wishes to expand its business by marketing its product to care-homes, hospitals and other healthcare facilities, where hygienic lavatories are of major importance in the drive to control infection. It is with this in mind that the current project is being undertaken. Previous investigations have demonstrated that activated charcoal will adsorb bacteria and viruses,[1,2] but no data are available for the Panfan device. In this report we describe our experimental design to investigate the ability of the Panfan device to trap microorganisms, and present the results from our early experiments.

Experimental

A key factor in these investigations was the design of appropriate experiments to measure the proportion of microorganisms that could be trapped by the charcoal filter of Panfan. To this end, a piece of apparatus was custom-built by Mr Charles May that employed a Panfan device connected to a chamber allowing air to be drawn through the filter and onto an agar plate position inside (Figure 1). The air from the box exits at a vent, next to which agar plates were also positioned. The chamber was located in a lavatory in the Ardmore House Annex of the UCD School of Biomolecular and Biomedical Science, and was automatically switched for 4 min upon someone entering the toilet. Agar plates were changed at regular intervals, and control experiments were conducted in which no filter was attached to the unit. Thus the number of microorganisms that were drawn into the box could be determined in the presence and absence of filter. Furthermore, the number of microorganisms that were inside the filter was determined at the end of the experiment by removing the charcoal

[1] Naka et al. (2001) Adsorption effect of activated charcoal on enterohemorrhagic *Escherichia coli*. J Vet Med Sci, *63*, 281-285

[2] Clark et al. (1998) In vitro studies on the use of clay, clay minerals and charcoal to adsorb bovine rotavirus and bovine coronavirus. Vet Microbiol, *63*, 137-146.

pad from the casing, placing it in a stomacher bag containing 100 ml of sterile Ringer solution, and treating with a stomacher for 5 min. Dilutions of the Ringer solution were made and plated onto nutrient agar.

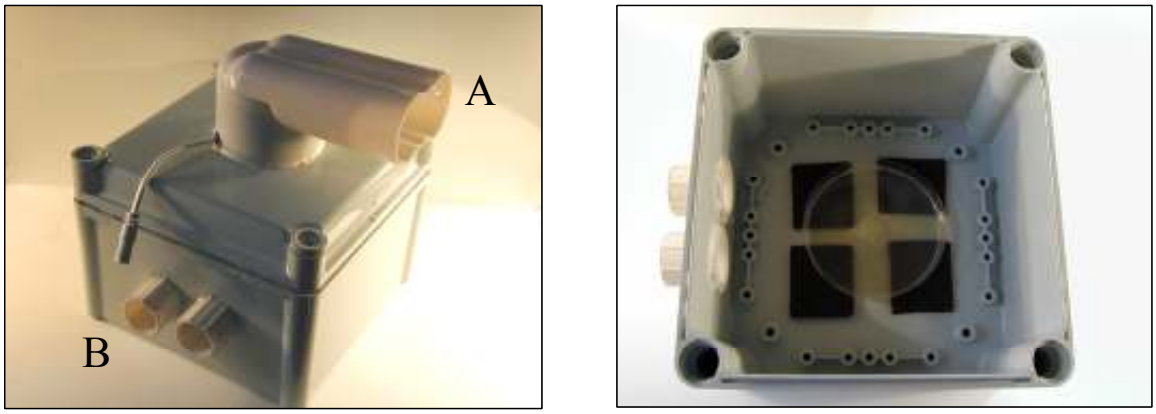

Figure 1. Photograph of the apparatus used to conduct experiments with Panfan. On the left is the complete box into which air is sucked in through the Panfan (A) and escapes through the vent (B). On the right is the chamber with the lid removed showing the location of the agar plate.

Results

A summary of several experiments to determine the number of airborne microrganisms that pass through the charcoal filter is presented in Figure 2. When no filter is attached, an average of 235 microorganisms per hour were determined on agar plates that were placed inside the chamber, and 335 microorganisms per hour were counted on plates that were placed outside the chamber next to the vent. When the filter is in place the number of microorganisms determined dramatically dropped to <10 on plates either inside or outside the chamber. Examples of typical agar plates collected in the experiments are shown in Figure 3. Therefore it can be inferred that approximately 99 % of airborne bacteria and fungi are trapped in the filter.

Future work

Experiments are currently underway to examine the effective lifetime of the Panfan filter, and to determine if filters impregnated with antimicrobial compounds are more effective than untreated ones.

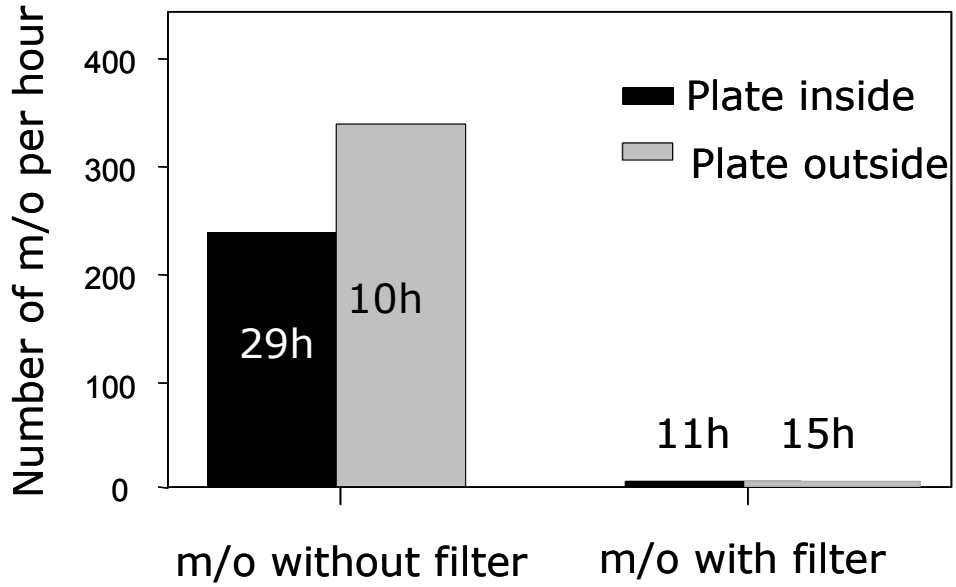

Figure 2. The number of microorganisms per hour (bacteria and fungi) that were counted on agar plates in the presence and absence of the charcoal filter. The plates were placed inside the chamber and outside the chamber next to the air vent. The total timeframe of each experiment is shown on the bars.

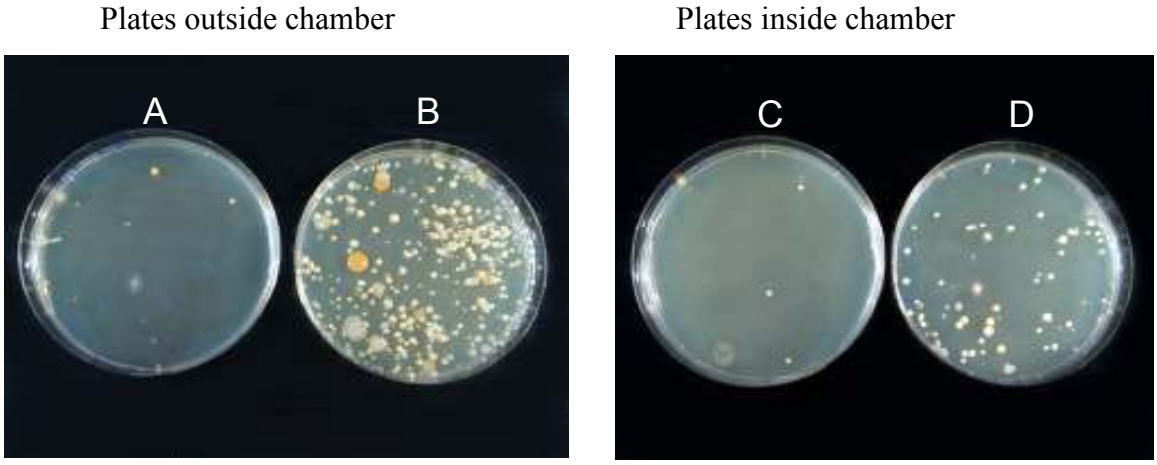

Figure 3. Photographs of typical agar plates that were exposed to air in the presence (A, C) and absence (B, D) of the charcoal filter.