Wickham Laboratories
Contract Analytical Services

Case Study on the Bioburden of the New Polymer £5 Note

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Case Study: Testing the Bioburden of the New Polymer £5 Note

Introduction

A £5 paper note is exchanged multiple times in the UK and over its lifespan, therefore there are multiple opportunities for the note to become contaminated with bacteria for example where the note has come in contact with contaminated surfaces or is handled by individuals who have not washed their hands after going to the toilet or coughing. The £5 note can quickly become a vehicle for bacterial transfer. The Bank of England have decided to move to polymer £5 notes and will be withdrawing the paper £5 notes owing to polymer notes being seen as cleaner, safer and stronger than paper notes.

There have been multiple studies performed on the level of contamination of paper money. Many of these studies have focused on the transfer of potential pathogenic microorganisms (1,2). The paper £5 note has at least 136 exchanges in a year, therefore in a two-week period a new polymer £5 note can be expected to be exchanged 5-6 times (3).

Wickham Laboratories Limited (WLL) were set out to investigate the level of contamination of the new £5 polymer note after it had been in circulation for two weeks with real life handling scenarios. Along with the level of contamination the types of microorganisms isolated were also identified.

Materials and Methods

Handling of the Notes

Nine new £5 polymer notes were taken out of circulation and were sanitised by spraying with 70% isopropyl alcohol and left to dry under a laminar flow cabinet for 30 minutes. Each £5 note was then placed into a sterile stomacher bag and was handed to nine WLL members of staff. The £5 polymer notes were then stored as per the person's usual manner of storing money may that be in a wallet, purse or pocket. Over a two-week period, the nine £5 polymer notes were exchanged six times on prearranged dates between different members of WLL staff. They were handled outside the laboratory environment to simulate real transactions.

Testing the Bioburden of the Notes

Each £5 polymer note was placed into an individual, sterile stomacher bag after which 100mL of wash fluid (0.1% w/v Peptone in Saline with 0.05% v/v Tween 80 solution) was added to each stomacher bag. Each stomacher bag containing the £5 note and the wash fluid was then stomached for approximately 1 minute each. The reciprocating paddles of the stomacher operate the bag forcing the wash fluid around the £5 note to remove the microorganisms present. Two 1mL aliquots of the wash fluid were transferred into two Petri dishes and poured with Tryptone Soya Agar (TSA). The remaining wash fluid was then transferred to a sterile filtration apparatus and filtered through a 0.45µm filter under vacuum. The filter membrane was then transferred using sterilized forceps, to a pre-poured TSA plate. The TSA plates were incubated at 30-35°C for 3 days. The colonies were counted and the recovery of bacteria from each £5 polymer note was calculated. All bacteria isolated were identified using Matrix Assisted Laser Desorption Ionisation Time of Flight (MALDI-ToF).

Results and Discussion

All of the nine £5 polymer notes were found to be contaminated with bacteria. The microbial load obtained from the nine notes varied from 31 colony forming units (CFU) to 4600 CFU/note (Table 1).

Table 1: Recoveries of Microorganisms from £5 Polymer Note

Colony Forming Units (CFU)	Microorganisms isolated
246	*Micrococcus luteus, Bacillus vallismortis, Bacillus atrophaeus, Staphylococcus warneri, Staphylococcus lugdunensis*
1750	*Micrococcus luteus, Bacillus vallismortis, Staphylococcus warneri*
73	*Micrococcus luteus, Bacillus vallismortis, Bacillus atrophaeus, Staphylococcus warneri, Staphylococcus lugdunensis*
60	*Micrococcus luteus, Bacillus vallismortis, Bacillus atrophaeus, Staphylococcus warneri, Staphylococcus lugdunensis*
60	*Micrococcus luteus, Bacillus vallismortis, Bacillus atrophaeus, Staphylococcus warneri*
118	*Micrococcus luteus, Bacillus vallismortis, Staphylococcus warneri, Staphylococcus lugdunensis*
31	*Micrococcus luteus, Bacillus vallismortis, Staphylococcus warneri, Staphylococcus lugdunensis*
4600	*Micrococcus luteus, Bacillus vallismortis, Staphylococcus warneri, Staphylococcus lugdunensis*
186	*Micrococcus luteus, Bacillus vallismortis, Bacillus atrophaeus, Staphylococcus warneri, Staphylococcus lugdunensis*

All of the nine £5 polymer notes isolated similar types of bacteria and all were found to be to gram positive organisms. The most predominant organism isolated on all of the notes was *Micrococcus luteus*. *Micrococcus luteus* is a part of the normal bacterial flora of human skin and is considered as non-pathogenic; it can also be found in soil, dust, water and air. The second most predominant organism isolated was *Bacillus* species. Bacillus are widely distributed throughout nature, and can be found in soil, dust, water and air. The two species isolated, *Bacillus vallismortis* and *Bacillus atrophaeus,* are not considered as pathogenic.

Finally, two different coagulase-negative *Staphylococcus* species were isolated, *Staphylococcus lugdunensis* and *Staphylococcus warneri*. Coagulase-negative *Staphylococcus* species are predominant members of the normal human skin flora and generally considered to be non-pathogenic.

No faecal indicator organism known as 'coliforms' were isolated from any of the notes. This may indicate that those who recently handled the notes had good personal hygiene, or that the note does not provide favourable conditions for this group of bacteria to survive.

Previous studies performed have shown that the number of bacteria recovered from polymer notes have been noticeably lower when compared to the recoveries from paper notes (2,4). However, it has not been shown that the polymer notes have a toxic effect on the bacteria, but that they do not provide a suitable habitat to support long term bacterial survival (5). It is possible that the paper notes provide a good surface for bacterial attachment due to the notes absorbent coarse fibres. The polymer notes have a smooth non-absorbent surface which provides poor bacterial adherence, hence the lower recoveries.

References

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