BANKNOTES AND THE SARS VIRUS

Background

Recent media articles have made reference to the People's Bank of China and the Industrial and Commercial Bank of China taking measures to ensure that banknotes do not aid the spread of the SARS virus. A spokesman from the Industrial Commercial Bank of China said, "When suspicious banknotes come back in, we first sterilize them with disinfectant, and expose them under ultraviolet light for four hours." (China Daily 29/4/03 <www1.chinadaily.com.cn/news/2003-04-29/113579.html>) Three other articles related to this story include 'Banking institutions take measure against SARS' 'Chinese banks quarantine cash' (SMH 29/4/03), 'Banknotes suspect as China delays their re-use' (AFR 30/4/03) and 'The dangers lurking in filthy lucre' (FT 6/5/03).

To enable the Bank to respond to any enquiries from the public, commercial banks and armoured car companies regarding any action that could be taken to prevent the spread of the virus via banknotes should SARS become an issue in Australia, we contacted the CSIRO.

Earlier Research

The CSIRO had earlier conducted a study for the Bank entitled, 'Microbial populations on banknotes'[1]. The study compared bacterial growth on polymer and paper notes, and concluded that "die-off of microbial populations is more rapid on polymer notes than on the paper notes"; and that "banknotes pose minimal risk of transmission of disease." Following the report, consideration was given to extending the study to viruses. However, one of the report's authors, Dr Annabelle Duncan, indicated that viruses were less likely to be present on banknotes than bacteria; and that the CSIRO did not have equipment to examine notes for viruses. The matter was not pursued.

Viruses and Banknotes

The Bank again sought Dr Duncan's advice regarding the behaviour of viruses on banknotes. In the event, Dr Duncan was overseas, but her colleague, Dr Paul Savage, provided a detailed written response. The text of NI's the email exchange with the CSIRO is attached. Following a subsequent telephone conversation with Dr Savage, some additional comments have been included. The main points to emerge are as follows.

First, viruses are quite different to bacteria. A bacterium is a cell made up of DNA (the cell's instruction set) and cytoplasm (water and enzymes) inside a cell membrane. The enzymes enable chemical reactions to occur for growth and reproduction. A virus is made up of DNA inside a protein coating, but contains no enzymes. A virus uses the enzymes of a host cell to survive and reproduce. If no host cell is found the virus dies. A viruses' survival time depends on the thickness of its protein coat. Cold and flu viruses can survive a long time outside a host cell because of their thick protein coat. HIV, however, has a short life outside its host cell. We understand the SARS virus can survive for up to one week before its infectivity is markedly reduced.

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[1] 'Microbial populations on banknotes' (1995) by Duncan, McLean & Kelly

Turning to their survival on banknotes, bacteria can break down and consume the paper note and the material deposited on the paper note. However, bacteria have difficulty breaking down polymer, and therefore can only consume the material deposited on the note. Viruses cannot use a banknote or material on a banknote as host cell. Therefore, viruses simply sit on the banknote (and do not multiply) until they die or are transferred to another location where they can come into contact with some host cells. There is nothing present in polymer notes that is harmful to viruses.

Regarding the transmission of viruses, banknotes should not be singled out as posing a significantly greater risk for the transfer of viruses than other regularly touched surfaces such as escalator handrails, coins, and door handles. Higher risks are posed from travellers and perhaps mail (licked envelopes) from SARS affected countries.

Turning to possible sterilisation procedures, three options include:

- Washing notes with alcohol and detergents. However, this would be slow and impractical.

- Exposing each side of the note to UV light for between 30 minutes and 7 hours depending on the virus or bacteria. The length of time for the SARS virus is unknown.

- Irradiating notes with gamma rays. This could be done by the pallet and would be the most time efficient method.

The second and third options may involve some capital expenditure.

A quarantining policy would be costly and ineffective. As soon as quarantined notes are released into circulation they can, potentially, become contaminated again, requiring further quarantining. If the Bank were to undertake or recommend a quarantining policy, it would require a sufficient stock of new or reissuable notes to replace any notes removed from circulation. Scientific equipment would have to be purchased or hired, and scientists would be required to guide the process. A costly policy for something that involves no more risk than other regularly touched surfaces such as escalators, coins, and door handles.

Finally, it appears the most effective way to reduce risk of spreading viruses (and bacteria) is for individuals to practise good personal hygiene. This includes washing hands before eating and (for food outlets) a separation of money handling from food handling.

Research & Technology
Note Issue Department
30 May 2003

DRHaynes

DIARY NOTE

BANKNOTES AND THE SARS VIRUS

Following is an email I sent to Dr Annabelle Duncan and a reply received from Dr Paul Savage of the CSIRO regarding banknotes and the SARS virus. I have annotated the email with my comments after having a conversation with Dr Savage on 16 May 2003.

-----Original Message-----
From: HAYNES, Danny
Sent: Monday, 12 May 2003 10:13 AM
To: Annabelle Duncan (E-mail)
Subject: Banknotes and the SARS virus

Dear Dr Duncan

A colleague of mine at the Reserve Bank of Australia suggested I contact you. Elaine Kerrison had met with you at a presentation of your work on 'Microbial populations on banknotes' in 1995. We have noted with interest in recent media articles, reference to the possible survival of the SARS virus on banknotes. Four articles include 'Banking institutions take measure against SARS' (China Daily 29/4/03), 'Chinese banks quarantine cash' (SMH 29/4/03), 'Banknotes suspect as China delays their re-use' (AFR 30/4/03) and 'The dangers lurking in filthy lucre' (FT 6/5/03). They led us to ponder the issue.

We have revisited your paper, 'Microbial populations on banknotes' (1995) by Duncan, McLean & Kelly, which studied bacteria, and concluded among other things that "die-off of microbial populations is more rapid on polymer notes than on the paper notes", and that "banknotes pose minimal risk of transmission of disease."

We understand that at the time of the report you thought viruses would be less likely to appear on banknotes than bacteria, but that the CSIRO did not have the equipment to examine notes for viruses.

We want to be prepared to respond to any enquiries from the public, commercial banks, armoured car carriers etcetera should the matter be raised.

We are interested in the following issues:

1 What is your view as to whether viruses could survive on banknotes? Would this differ for paper and polymer banknotes? How long might they survive?

2 Is there anything in polymer notes that may be harmful to viruses and reduce the risk of transmission.

3 Would you advise notes being quarantined? For how long should notes be quarantined? Would there be a means to treat individual notes, if desirable?

4 Should notes be singled out as a concern compared to, for example, coins, credit cards, public transport tickets and systems, escalators, public toilets?

We are not looking for formal advice, but only background information. Any ideas would be greatly appreciated. I would welcome the opportunity to discuss these issues with you.

Thanking you in advance for your assistance.

Yours sincerely,

Danny Haynes
Senior Research Officer
Note Issue Department
Reserve Bank of Australia
GPO Box 3947
Sydney NSW 2001

-----Original Message-----
From: Paul.Savage csiro
Sent: Tuesday, 13 May 2003 10:36
To: HaynesD
Cc: Annabelle.Duncan csiro ; Gerry.Wilson csiro
Michael.Zachariou csiro.
Subject: RE: Banknotes and the SARS virus

Hello Danny,

Annabelle is overseas at the moment so I will respond to your request on her behalf. If you need to follow up on any of this information please feel free to give me a call on . I have received information from our microbiologist project leader and also Keith McLean (one of the other original authors of the report) and the following is a summary of their responses.

The aim of the report was to compare and contrast the 'cleanliness' of polymer notes compared to paper ones. They sampled a lot of notes from various sources and also tried to grow microbes on various pristine examples of polymer and paper notes. They found that there was only a marginal increase in 'cleanliness' for the polymer notes over the paper ones – and that there was in fact a very broad variability within both categories anyway.

Plastic is meant to be more difficult for bacteria (not viruses) to grow on than paper since it is more difficult to break the plastic to monomers than it is to break down the paper and ultimately get glucose as a carbon source. It's probably that carbon sources provided through human contact (particularly from foods) could coat the bank note and provide a nutrient source for microbial (not virus) growth. Given that, the

increased porosity and wetability of paper over plastic would lead you to surmise that, especially older, paper notes would tend to harbour bacterial colonies better than plastic. [*In order to grow and reproduce, bacteria break down and consume the paper note and any material on the paper note transferred by human contact eg. food and beverages. However, bacteria have difficulty breaking down polymer, and therefore can only consume the material on the surface of the note.*]

Viruses on the other hand need a host to replicate otherwise they are not considered living entities. Unlike bacteria and fungi, when viruses are on a surface they are dormant. During this dormant period they need to be able to remain intact enough to infect. [*Viruses cannot use a banknote or material on a banknote as host cells. Viruses simply sit on the banknote (and do not multiply) until they die or are transferred to another location where they come into contact with some host cells.*] Viruses that infect humans need to be able to survive outside their host for long enough periods to allow for the next cycle of infectivity. Some viruses are more tenacious than others and can withstand prolonged periods of non-infectivity. My superficial understanding of the SARS virus is that it can survive on surfaces for up to 1 week before its infectivity is markedly reduced. Other viruses (e.g. papilloma viruses that cause warts etc) can survive for 3-4 weeks on surfaces without affecting their infection capacity. Herpes viruses can last up to 48 hours outside the host. So it is a virus specific situation. [*The cold and flu viruses have a long life outside the host cell because of their protein coat. HIV, however, has a short life outside the host cell.*] If you are talking about quarantine periods and wish to make it a general antiviral then it would have to be in the order of weeks. If we assume that one can catch a disease from banknotes then quarantine or washing them will only help a little because as soon as they enter circulation they can become contaminated again.

In relation to your specific numbered queries below:

1. From the above we wouldn't expect a great difference in the survival rate of viruses on paper versus plastic (bacteria are a different story), and the survival time is dependant on the virus.

2. I don't believe there's anything in plastic banknotes that's harmful to viruses -- although it raises an interesting possible research opportunity: can polymer banknotes be surface modified or contain chemical agents in the polymer substrate to increase their antimicrobial characteristics?

3. Our feeling is that quarantine is not going to be very practical generally because of the time involved, although it might be worth it for notes coming into the country from SARS hotspots. Washing with alcohol, detergents, etc. would work but may also be impractical. [*Washing with detergents and soaps may kill bacteria but would only remove viruses from the surface of the note*.] Perhaps a better option is to expose the notes to the right wavelength and energy UV light, which is a good source of sterilisation for viruses and bacteria. [*Both sides of each note would need to be exposed to UV light as it does not penetrate the substrate.*] One of our guys suggested a UV source in ATMs, for example, might be a good way to significantly decrease money-borne spread of disease generally. It may also decrease the lifetime of the banknotes but that could easily be tested. Another possibility is gamma irradiation since that penetrates the substrate and could be used to treat a pallet-load of notes at a

time. [*Gamma radiation is used to sterilise long-life foodstuffs*] Gamma radiation certainly destroys bacteria but we would have to check about viruses.

4. No, notes shouldn't be singled out. All regularly touched surfaces are suspect including escalators, coins, door handles etc. as you listed. Indeed, one significant worry might be the mail system -- especially letters from developing nations where "licked" envelopes and stamps are commonly used and the incidence of disease is higher. In this case also a UV treatment might be beneficial.

Finally, probably the most effective way to reduce risk is obviously good personal hygiene -- washing hands after handling money or touching public places, before eating and so on. The chance of contracting a bacterial or viral infection from banknotes or any surface (or indeed from airborne pathogens) rises with dose and method of ingestion, e.g. merely handling money versus smelling or licking it, or the presence of lesions on the hands to allow blood contact etc.

If the Reserve Bank is looking for a competitive advantage of plastic over paper for marketing purposes it may well be that certain modifications of the polymer could lead to increased disease resistance. I would encourage you to contact the Program Leader in this area, Dr Gerry Wilson (gerry.wilson@csiro.au), to discuss options further.

I hope this has been of some assistance.

Cheers,

Paul
--
Dr G Paul Savage
Acting Deputy Chief
CSIRO Molecular Science,

-----Original Message-----
From: HAYNES, Danny
Sent: Friday, 23 May 2003 4:52 PM
To: 'Paul.Savage csiro
Subject: RE: Banknotes and the SARS virus

Dear Paul,

Thank you for your response to my enquiry. We found your answers helpful and comprehensive. I would like to ask some follow up questions to your response to issue three:

3.1 For how long would each side of a banknote have to be exposed to UV light before the virus was sterilised? Is it something that could be done in a moment as a note passes through an ATM or is it a matter of minutes or hours? A spokesman from the Industrial Commercial Bank of China said they "sterilize them with disinfectant, and expose them under ultraviolet light for four hours."

<http://www1.chinadaily.com.cn/news/2003-04-29/113579.html> Is the amount of time different for each type of virus?

3.2 Gamma radiation seams to be an efficient method of treating banknotes in great bulk. Is gamma radiation effective against viruses, not just bacteria?

Thank you for your assistance.

Yours sincerely,

Danny Haynes
Senior Research Officer
Note Issue Department
Reserve Bank of Australia
GPO Box 3947
Sydney NSW 2001

-----Original Message-----
From: Paul.Savage csiro.
Sent: Monday, 26 May 2003 17:59
To: HaynesD rba
Subject: FW: Banknotes and the SARS virus

Danny,

I passed on your questions to Mike Zachariou, the project leader of our chemical biocatalysis group and his answer is copied below. Unfortunately there is no one answer and, as in most things scientific, the actual answer is “it depends”.

Regards,

Paul

-----Original Message-----
From: Zachariou, Michael (MOLSCI, Clayton)
Sent: Monday, 26 May 2003 5:52 PM
To: Savage, Paul (MOLSCI, Clayton)
Subject: RE: Banknotes and the SARS virus

Hi Paul,

3.1 To disinfect/sterilize there are two main parameters that are important. Firstly, the amount of disinfectant (or UV light) and secondly the time of exposure. Often one can be compensated by the other but not in all cases since the contaminating excipient also plays a role. Below you will note some data that imply that one will require several

hours of UV sterilization. You will also note that the magnitude of UV sterilization required will vary not only from virus to virus but also from bacteria to bacteria etc. The hardier the organism e.g enveloped virus compared to non-enveloped virus, the harsher the radiation needs to be and/or the longer the exposure. A minimum of 30 minutes UV radiation would be required as a general dose but this could be extended to 6-7 hours for hardier microorganisms. However, please note that the effect of UV irradiation has not been studied with all viruses and only a representative sample of viruses are included below and excludes the SARS virus. In my opinion, passing through a UV scanner for a few seconds would not be sufficient unless it was coupled to a primary disinfection mode such as chemical disinfection, similar to the Chinese application.

3.2 Gamma irradiation is effective against treating viruses as well as bacteria. Much work in this area has been done in inactivating viruses found in blood products. In these studies they found that exposure time as well as dose varied depending on the virus type. As mentioned earlier the hardier viruses will require harsher treatment.

Table of UV doses required to inactivate some microorganisms including viruses:

Bacteria	**Dose - 90% (mW/sec/cm2)**
Agrobacterium Tumefaciens	4,2
Bacillus Anthracis	4,5
Bacillus Megaterium (Sporen)	9,07
Bacillus Megaterium	3,75
Bacillus Subtilis (sporen)	12
Bacillus Subtilis	7,1
Bacillus Paratyphosus	3,2
Bacillus Enteritidis	4
Corynebacterium Diphteriae	3,75
Clostridium Tetani	4,9
Clostridium Botulinium	12
Dysentery Bacilli	2,2
Eberthella Typhosa	2,14
E. Coli	5,4
Leptospira Spp (Infectious Jaundice)	3
Legionella Pneumophila	2,04
Legionella Bozemanii	1,8
Legionella Dumoffii	3
Legionella Gormanii	2,5
Legionella Micdadei	1,5
Legionella Longbeachae	1,5
Listeria Monocytogenes	3,4
Micrococcus candidus	6,05
Micrococcus sphaeroides	10
Micrococcus Lysodeikticus	23
Micrococcus Radiodurans	20,5
Micrococcus Piltoniensis	8,1
Mycobacterrium Tuberculosis	6,2
Neisseria Catarrhalis	4,4
Phytomonas Tumefaciens	4,4

Bacteria	**Dose - 90% (mW/sec/cm2)**
Proteus Vulgaris	3
Pseudomonas Aeruginosa	5,5
Pseudomonas Fluorescens	3,5
Salmonella Enteritidis	7,6
Salmonella Paratyphi	6,1
Salmonella Typhimurium	8
Samonella Typhosa	6
Sarcina Lutea	19,7
Serratia Marcesens	2,42
Shighella Dysenteriae	4,2
Shigella Paradysenterea	1,68
Shigella Flexneri	1,7
Shigella Sonnei	2,1
Spirillium Rubsum	4,4
Staphylococcus Albus	1,84
Staphylococcus Aureus	2,6
Streptococcus Haemolyticus(A)	6,7
Streptococcus Haemolyticus(D)	9,5
Streptococcus Lactis	6,15
Streptococcus Viridans	2
Streptococcus Pyrogenes	2,16
Streptococcus salivarius	2
Tuberculose Bacillus	10
Vibrio cholerae	6,5

Virus	**Dose - 90% (mW/sec/cm2)**
Adenovirus 3	1,5
Bacteriophage (E. Coli virus)	3
Coxsackie virus A9	12
Coxsackie virus B1	15,5
Echovirus 1	11
Echovirus 2	12
Hepatites A	11
Infectious hepatitus virus	8
influenza	3,4
Poliovirus (poliomyelltis)	6,5
Poliovirus 1	11
Poliovirus 2	12
Poliovirus 3	10
Reovirus 1	15,4
Rotavirus SA11	7,8
Tobacco Mosaic Virus	240

Fungus	**Dose - 90% (mW/sec/cm2)**
Aspergillus Niger (bread)	100
Aspergillus Amstelodami (meat)	70
Aspergillus Niger	132

Fungus	**Dose - 90% (mW/sec/cm2)**
Aspergillus Flavus	60
Aspergillus Glaucus	44
Cladosporium Herbarum (Cold Stores)	70
Fungi from Manure, soil, etc	120
Mucor Mucedo (meat fat bread cheese)	70
Mucor Racemosus a/b	17
Mucor Ramosissimus	17
Oospara lacis	5
Penicillium Digitatum	44
Penicillium Expansum	13
Penicillium Chrysogenum	50
Penicillium Roqueforti	13
Rhizopus Nigricans	110
Scopulariopsis Brevicaulis (Cheese)	80

Paul. I believe that much development time would be required to get this optimized for a banking use.

Dr. Michael Zachariou
Project Leader, Chemical Biocatalysis
Molecular Science, CSIRO

Research & Technology
Note Issue Department
2 June 2003

DRHaynes

From: TURTON, Terence
Sent: Tuesday, 15 January 2013 2:17 PM
To:
Cc: NI - Enquiries
Subject: RE: germs and bank notes [SEC=UNCLASSIFIED]

Dear

It is good to hear from you. I hope all is going well in your new role.

In answer to your questions, the Reserve Bank has not conducted or commissioned a study into the carriage of germs on banknotes.

In 2009, when there was international concern about swine influenza, we did look into the existence of any such studies in preparation for the potential that it may be raised during media interviews. We came across one scientific paper, Survival of Influenza on Banknotes (2008) authored by a number of scientists who worked for various Swiss organisations or government agencies and was supported by the Swiss Federal Office of Public Health. This study specifically considered whether the influenza virus could survive and ultimately be transmitted on banknotes. The study considered paper banknotes only, though it did cite some survival rates of influenza viruses on non-porous surfaces. You can find a copy of the article about the study here: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2394922/.

The 2010 Ballarat University study that you have referred to ('Dirty Money: An investigation into the hygiene status of some of the world's currencies as obtained from food outlets'), was conducted without any input from the Reserve Bank. You may, however, find this article on Science Alert (http://www.sciencealert.com.au/news/20101308-21231.html) to be interesting. In it, the lead researcher Dr Frank Vriesekoop is quoted as saying that none of the banknotes tested carried alarming levels of bacteria, that the level of bacteria was affected by the age of the banknotes and the material from which they were produced and that polymer banknotes carried significantly less bacteria than cotton-based banknotes.

I hope this information is helpful, but if you have any other questions, please don't hesitate to get back in touch.

Regards,

Terence

Terence Turton | Senior Manager, Communication, Note Issue
RESERVE BANK OF AUSTRALIA
65 Martin Place, Sydney NSW 2000
| w: www.rba.gov.au

From:
Sent: Thursday, 10 January 2013 12:30 AM
To: TURTON, Terence
Subject: germs and bank notes

Good day,

Are you aware of any studies done about germs carry by bank notes? Has RBA ever done or commissioned such a study? What about Ballarat University? It seems that they studied the issue; is it serious?

Many thanks in advance for your help

From: MUKE, Sani
Sent: Monday, 28 April 2014 8:17 AM
To:
Subject: RE: Bank note cleanliness [SEC=UNCLASSIFIED]

Thanks and

Yes, we were aware of the Australian study

There appears to be some conflicting results between research in 3.1 and 3.2. In 3.1 the research suggests bacteria survive longer on polymer banknotes compared to the 3.2. In 3.1 they don't explain why the "polymer structure of the Romanian Lei allows growth and transmission of multi-drug resistant pathogens" and there are also some conflicting results for paper banknotes that are not explained. Furthermore in 3.1 they do not perform tests on a statistically sound sample size.

Regards,

Sani

From:
Sent: Saturday, 26 April 2014 1:55 AM
To:
Cc: MUKE, Sani
Subject: RE: Bank note cleanliness

*** PGP Decrypted Message**

Hello, and thanks, I had found this previously as part of the research I was conducting, the summary was:

3.2 Dirty Money: An Investigation into the Hygiene Status of Some of the World's Currencies as Obtained from Food Outlets. Journal : Foodborne Pathogens and Disease Volume 7, Number 12, 2010 University of Ballarat, Australia.
This study looked at banknotes from food outlets in Australia, Burkina Faso, China, Ireland, the Netherlands, New Zealand, Nigeria, Mexico, the United Kingdom, and the United States. The presence of bacteria on banknotes was found to be influenced by their age and substrate, and there was a strong correlation between the number of bacteria per square centimetre and economic prosperity of the various countries. It was found that pathogens could only be isolated after enrichment and their mere presence was not alarming. It recommends good hygiene when handling food and money. The study revealed that polymer banknotes have a relatively low bacterial count compared with the cotton-based banknotes. Polymer's smooth surface hindered the adherence of bacteria. Cotton-based banknotes provided ample opportunity for bacterial attachment. **This study reference was supplied by Innovia, but the author states there is no competing financial interest.**

I also found these others

3. Studies on micro organisms on banknotes.

3.1 Money and transmission of bacteria[1]
This study focused on the survival of bacteria on banknotes from different countries and the transmission of bacteria to people who came in contact with them. Paper notes (Euro, US, Canada, Croatia, India and Morocco) were compared to the Romanian Leu (polymer). The Leu was the only currency where bacteria remained detectable

after 24 hours. The second study involving transmission (rubbing notes for 30 seconds) compared the Euro with the US Dollar and the Leu. Only the Euro showed no transmission to humans.

This study was reported in the New Scientist under the title 'New UK banknotes could provide cosy home for bugs' and in the Daily Mail under the title 'Bank of England's plastic bank notes will be a 'breeding ground' for superbugs, say researchers'. The study is further reported in a number of news agency web sites. Comments to the New Scientist article pose questions such as whether transmission of the organisms from banknotes is harmful to humans, (given that we are all exposed to the bacteria in every day life from other sources), that banknotes are just another surface which has the potential to be contaminated and that the headline is alarmist. The Independent reported Professor Hilton at Aston University as stating his own research into bacteria on banknotes showed that ''the quantities of bugs found on money was comparable to other daily objects and highly unlikely to amount to an infectious dose. Plastic banknotes present no greater risk that any other plastic object from a plant pot to a credit card. I don't think there is going to be a spike of infections as a result of the introduction of plastic banknotes."

Small studies had been undertaken with undergraduates but not published. A further study is planned for Q1 2014, and I have asked for a copy of the findings when ready.

3.3 Isolation of pathogenic microorganisms from contaminated paper currency notes in circulation from different market places in Korogwe and Mombo towns in Tanzania. J. Microbiol. Biotech. Res., 2012, 2 (3):470-474 http://scholarsresearchlibrary.com/JMB-vol2-iss3/JMB-2012-2-3-470-474.pdf

This study found that, perhaps unsurprisingly, lower denominations harboured more bacteria.

3.4 Antibiotic Resistant Bacterial Contamination of the Ghanaian Currency Note: A Potential Health Problem J. Microbiol. Biotech. Res., 2011, 1 (4): 37-44 http://scholarsresearchlibrary.com/JMB-vol1-iss4/JMB-2011-1-4-37-44.pdf

The results from this study showed that Ghanaian currency notes in circulation are contaminated with various microbial agents of which most are resistant to commonly used antibiotics. The author then deduces that this represents a risk to the community.

From:
Sent: Friday, April 25, 2014 4:38 PM
To:
Cc: MUKE, Sani @rba.gov.au)
Subject: Bank note cleanliness

This email has reached the Bank via the Internet or an external network

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Hi I believe were looking into this type of research. The article below states that 3000 types of bacterial are found on paper notes but less on polymer notes...they quote 2010 Australian study regarding improved performance ... lemme know if you need translation. I have attached the link to the original Wall street Journal article and the abstract to the Aussie study

Sani...did you know about the Australian study?...news to me, but that's not surprising

> Les Affaires - 04/26/2014 - 127 words
> Les Affaires, no. No: 16

Actualités, samedi 26 avril 2014, p. 5
Sale argent...
C. Hébert

Mieux vaut vous laver les mains après une transaction en argent comptant ! Des chercheurs de l'Université de New York ont trouvé plus de 3 000 types de bactéries sur 80 billets de un dollar américain. En fait, ils ont trouvé tellement de micro-organismes qu'à peine 20 % d'entre eux ont pu être formellement identifiés. Parmi les bactéries connues, certaines sont liées à des gènes résistant aux antibiotiques, propageant l'E. coli ou encore causant des ulcères gastriques et la pneumonie.

La monnaie de l'oncle Sam n'est pas la seule monnaie «malpropre». De la roupie à l'euro en passant par le dollar canadien, tous les types de papier-monnaie de la planète figurent parmi les objets qui propagent le plus de bactéries. Mince consolation, une étude australienne a révélé en 2010 que les billets en polymère, notamment ceux que produit la Banque du Canada, étaient beaucoup moins accueillants pour les microbes que les billets issus d'un mélange de coton et de lin, la formule utilisée par les Américains.

http://online.wsj.com/news/articles/SB10001424052702303456104579489510784385696

Dirty Money: An Investigation into the Hygiene Status of Some of the World's Currencies as Obtained from Food Outlets

To cite this article:
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- Full Text HTML
- Full Text PDF (289.4 KB)
- Full Text PDF with Links (229.1 KB)

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School of Science and Engineering
University of Ballarat

From: EVANS, Amanda
To:
Cc: PYMM, Victoria
Subject: RE: Polymer banknotes handling - Covid19 [SEC=UNCLASSIFIED]
Date: Tuesday, 24 March 2020 3:57:09 PM

Dear

Thank you for your email. Victoria has asked me to respond on her behalf.

When directly asked, we have advised the public and media that a banknote should be treated just like any other surface. We advise practising good hygiene and following the advice from the Department of Health. This includes washing your hands and avoiding touching your eyes, nose and mouth. The Bank has not made a public statement via a formal media release. It is our view that the best advice people can follow is that mentioned above, from the Department of Health and the WHO.

Where required, we have also provided the following information: To clean a banknote without damaging it, you can gently wipe it with an alcohol, such as hand sanitiser, an antibacterial wipe or household bleach, following the instructions on the product.

Banknotes which are received by the RBA are either no longer fit for circulation and are destroyed, or they are surplus to current needs and are placed in storage for some months before being re-distributed. The time these banknotes spend in storage is longer than the period of time that studies suggest coronavirus can persist on a surface.

The RBA's policy is to destroy banknotes when they are no longer fit for circulation, typically because they have become sufficiently worn or otherwise damaged. The RBA will not be destroying banknotes outside its normal business practices. It will also not be disinfesting banknotes as a result of COVID-19.

With regards to our operations, there is a time lag when processing circulating banknotes that are returned to the RBA. Given the high volume of banknotes that our staff handle, we are taking a conservative approach and ensuring that this lag exceeds the period of time that studies suggest coronavirus can persist on a surface.

I hope this information has been useful.

Regards

Amanda Evans | Acting Manager, Banknote Planning & Partnerships | Note Issue
RESERVE BANK OF AUSTRALIA | 65 Martin Place, Sydney NSW 2000
| w: www.rba.gov.au

From:
Sent: Monday, 23 March 2020 8:37 AM
To: PYMM, Victoria
Subject: Polymer banknotes handling - Covid19

Good morning,
I hope you are doing well,
My name is of the currency department at
I have asked my friends from the company CCL Secure to introduce me to you so that I can ask you a few questions about the handling of polymer banknotes in this period of health crisis, given your long experience with this substrate.
Could you please tell me if you have taken any specific measures to protect the workers of the cash centre or to reduce the health risk to the general population?
Are polymer notes considered a potential vector for coronavirus transmission in your country and have you made a public statement on this issue?
Is there a way to automatically disinfect banknotes on a large scale?
Thank you in advance for your kind help.
Best regards

Currency Management Department