

**PAPER CURRENCIES, A POTENTIAL CARRIER OF PATHOGENIC  
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**ABSTRACT:** Microbial analysis of 500 Indian currencies collected from people of different categories across the state Assam (India) has shown the presence of various pathogenic microorganisms viz. *E. coli*, *Pseudomonas spp.*, *Klebsiella spp.*, *Streptococcus spp.* and *Staphylococcus sp.* which are known to be responsible for watery diarrhea, mouth skin diseases, pneumonia, respiratory track diseases, gastro intestinal diseases etc. This may be due to the climatic conditions of most of the third world Asian countries which favors the optimum growth conditions for the microorganisms and a huge number of carriers handling them due to larger population in these regions.

**Keywords:** *E. coli*, *Pseudomonas spp.*, *Klebsiella spp.*, *Streptococcus spp.*, *Staphylococcus spp.*

**INTRODUCTION**

Microorganisms are found in almost everywhere in our environment. Some microorganisms are useful but some are pathogenic. Though we ignore, unknowingly we used to bear many pathogenic microorganisms through some of the media which we use in our everyday life. One such media is our currency, which is used by people of all categories (Abrams *et al.* 1972). The same currency is circulated among so many people in a single day. Sometime it is seen that people used to shuffle their paper currencies using their spit and some time children used to put coins in their mouth. Though we ignore such things, but it may cause some skin diseases, digestive track diseases, respiratory track diseases etc (Anderson *et. al.* 1991). Most of the things we use in our everyday life work as a potential carrier of pathogenic microorganisms. One such media is our paper currencies. Those microorganisms can come into our body through hand to mouth operations if proper hygiene is not maintained and can cause severe stomach disease, respiratory track disease, skin disease etc. In our present study, microbial analysis of 500 Indian paper currencies were carried out to evaluate the presence of pathogenic microorganisms collected from various regions of the state Assam (India).

## METHODS AND MATERIALS

### Sample collection

A total of 500 Indian currencies (paper currencies only) from different places of Assam (North East, India) from people of various categories i.e., butchers, fish mongers, sweepers, roadside vendors, carpenters were collected. Paper currencies of 500 rupee, 100 rupee, 50 rupee, 20 rupee, 10 rupee, 5 rupee were collected for microbial analysis.

### Inoculation of samples

Paper currencies were directly inoculated in nutrient broth and allowed to incubate for 24 hrs at 36°C on a rotary shaker set at 120 rpm (Gadsby P., 1998). After 24 hrs 1ml of the broth from each samples were taken and serial dilution was performed up to  $10^{-8}$  fold and inoculated on NA plates and incubated at 36°C for 24 hrs. The bacterial colony characteristics were noted down and CFU was calculated.

### Identification of the bacterial isolates

The bacterial isolates were identified on the basis of various staining techniques and their biochemical characteristics prescribed by **Bergey's Manual of Systematic Bacteriology** (Vos D. P. et. al, 2009). The preliminary identification of the bacterial isolates was done by performing various staining techniques and observing the cell morphology under light microscope. Various biochemical tests were performed to identify the bacterial isolated from the currencies using commercially available test kits (KB001 HiIMViC biochemical test kit, KB002 Hi-Assorted biochemical test kit, KB004 HiStaph™ identification kit, KB005A HiStrep™ identification kit and KB003 Hi 25™ - *Enterobacteriaceae* identification kit) and allowing to grow on the selective media Macconkey's agar, Blood agar, EMB agar and Mannitol salt agar (all the medias and identification kits were purchased from HiMedia Laboratories Pvt. Ltd., India).

## RESULTS AND DISCUSSION

The study was done on 500 Indian currencies (paper currencies). A total of more than 2000 colonies were obtained out of which some of the bacterial colonies were identified depending on biochemical characteristics and also performing various staining techniques. Our study was limited up to the isolation and identification of some of the pathogenic bacteria only. In our present study we did not consider the geographical location and the climatic conditions of the places from where the samples were collected. The pathogenic bacteria were confirmed as *Pseudomonas spp.*, *E. coli.*, *Klebsiella spp.*, *Staphylococcus spp.*, and *Streptococcus spp.* (Table 1). Rest of the bacterial colonies could not be identified. Most of the dirty paper currencies which were collected mainly from the butchers, sweepers & fish mongers were found to be carrying most the pathogenic microorganisms. This may be due to the deposition of the moisture on the paper currencies which provides a favorable condition for the microorganisms to grow on it and probably the microorganisms are using the cellulose from the paper currencies as their sole carbon source. We recommend not shuffling the notes using spit. It is also recommended to wash the hands after frequent handling of notes before any hand to mouth operation.

**Table 1:** Results are tabulated below

+ = positive, - = negative, d/v = variable, +s = slow positive

CFU	Micro-organism	Grams reaction	Shape	Indole test	MR test	VP test	Citrate test	Catalase test	Carbohydrate fermentation test			Pathogenesis
									Glucose	Lactose	Mannitol	
2x10 <sup>8</sup>	<i>E. coli</i>	-ve	Rod	+	+	-	-	+	+	+	+	Virulent <i>E. coli</i> strains cause either noninflammatory diarrhea or inflammatory diarrhea (dysentery with stools usually containing blood, mucus, and leukocytes).
6x10 <sup>8</sup>	<i>Pseudomonas Sp.</i>	-ve	Rod	-	-	+/-		+	+	-	+	Skin disease
3x10 <sup>8</sup>	<i>Klebsiella sp.</i>	-ve	Rod	-	-	+	+	+	+	d/v	+	Mouth skin, intestinal diseases
2x10 <sup>8</sup>	<i>Streptococcus Sp.</i>	+ve	Cocci	-	-	-		-	+	+	+	Strep throat, meningitis, bacterial pneumonia
8x10 <sup>8</sup>	<i>Staphylococcus Sp.</i>	+ve	Cocci	-	+	-		+	+	+	+	<i>Staphylococcus aureus</i> is an uncommon cause of pneumonia in animals

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