



Industrial Consultancy & Sponsored Research (IC&SR)

3D paper-based microfluidic device for detecting multiple adulterants in liquid foods

IITM Technology Available for Licensing

Problem Statement

- It is noted that there is a huge demand of good quality of milk & to fulfil the demand, a few adulterants like **water/urea/ammonium sulphate/salt/sodium-hypochlorite/sugar/starch** etc. are added to increase the volume/whiteness/non-protein nitrogen of the milk.
- Further, due to **contamination in milk**, more **diseases** including renal failure, death in infants, gastro-intestinal complication, kidney diseases have a common concern for the customers.
- Hence, there is a requirement to introduce a **device** to mitigate above challenges & provide new **efficient solution**.
- This invention provides solution for said issues.

Technology Category/ Market

Technology: 3D paper-based microfluidic device;

Industry: Healthcare; **Applications:** Flow & pressure sensors, paper based microfluidic device for identify the level of **adulteration** in the liquid food or beverage (milk).

Market: The global microfluidic components market size is projected to **\$56.57B** by **2028**, at a **CAGR of 15.79%** during period of 2023-2028

Intellectual Property

IITM IDF Ref.:2141;

Patent Application No: 202141024502

Technology

- Present invention describes a **3D paper-based microfluidic device** designed for **detecting multiple adulterants in liquid foods**. (Refer FIG. 1)
- Said device comprises a **top cover**, a **bottom cover** & a **3D paper-based microfluidic layer** sandwiched between them.
- The **microfluidic layer** is formed by placing a solid support between the top layer of filter

paper(transportation zone)& a bottom layer of filter paper(detection zone).(Refer Fig 2&3)

- The device comprises a **plurality of holes** in the bottom layer for viewing the colourimetric reaction & a color band that helps to **identify** the **level of adulteration** in the **liquid food or beverage**.(Refer Fig.4 & Experimental image)
- A transparent cover is provided to reduce **reagent evaporation**.

Image of 3D paper-based microfluidic device



Fig.1: Illustrates a schematic view of the 3D paper-based microfluidic device for detecting multiple adulterants in liquid foods and beverages.

Reference Nos listed herein:

- 100:** 3D paper-based microfluidic device;
- 101:**Top cover; **102:** transparent cover;
- 103:** bottom cover; **104:** a top layer of the filter paper (transportation zone);
- 105:** a solid support between a top layer & bottom layer;
- 106:** a bottom layer of the filter paper (detection zone);
- 107:** color band to identify the approximate range of adulteration in the liquid food or beverage; **108:** a plurality of holes;
- 110:**3D paper-based microfluidic layer;

TRL (Technology Readiness Level)

TRL- 4, Proof of Concept & validated

Research Lab

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Technology Images

Fig.2: Illustrates a schematic view of the 3D paper-based microfluidic layer which is formed by sandwiching a solid support between a top layer of the filter paper (transportation zone) and a bottom layer of the filter paper (detection zone),

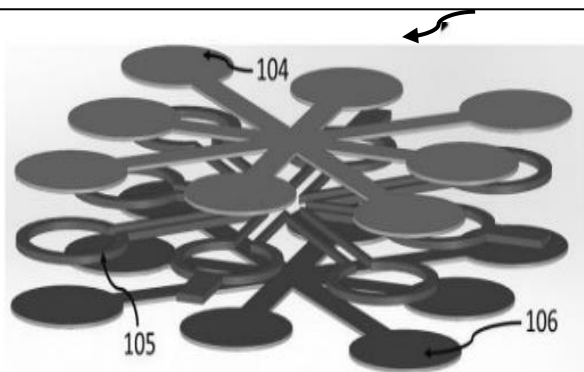
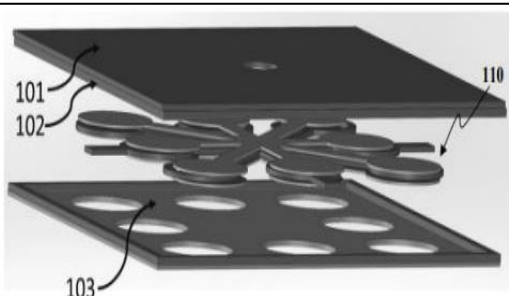


Fig.3: Illustrates an exploded view of the 3D paper-based microfluidic device;

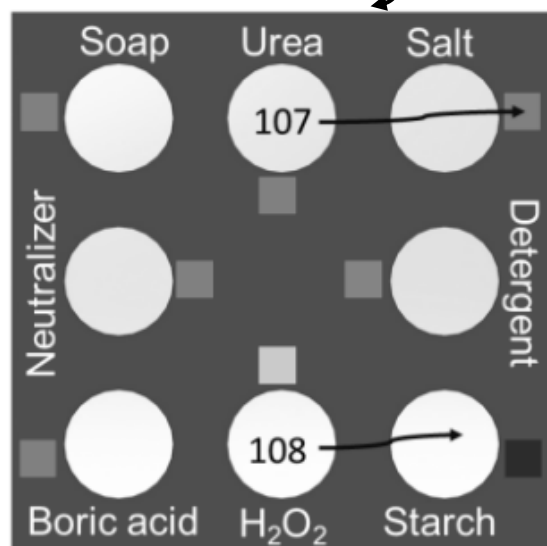


Experimental Results

Experimental result (below) illustrates graphical representation of colorimetric reaction of different adulterants in the liquid foods and beverages (Milk).

Adulterants	0.05%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%	0.9%	1%
Urea											
Starch											
Salt											
Detergents											
Boric acid											
H ₂ O ₂											
Soap											
NaHCO ₃											

Fig.4: a schematic view of the bottom cover of the 3D paper based microfluidic device for detecting multiple adulterants in liquid foods & beverages



Key Features / Value Proposition

❖ Technical Perspective:

1. Claimed device facilitates the **color band** which covers **adulterants** such as **urea, detergents, soap, salt, H₂O₂, boric acid, & neutralizers** found in liquid food like **milk**.
2. The device allows for **quantitative measurement** of the volume of **adulterants in the liquid food**, with a **detection limit** ranging from **0.1% to 0.4%** for different adulterants.

❖ Industrial Perspective:

1. **Cost-effective** device for detecting adulterants in the liquid food.

❖ User Perspective:

1. Ensures **more reliable & user-friendly** device.

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