LIQUID MICRO-MARBLES AND A PROCESS AND APPLICATIONS OF ENCAPSULATED LIQUIDS IN PARTICULATE MATERIALS

IITM Technology Available for Licensing

Problem Statement

- In the instance, a few prior arts method/techniques have discussed related to ultra phobic surfaces of the carrier cause liquids, micro fluidic device, other fluidic handling components, however unable to provide solutions as discussed in the present invention.
- Hence, there is a need to introduce present method which produce desired size of liquid marbles.

Technology Category/ Market

Technology: LIQUID MICRO-MARBLES; **Industry:** Petrochemical, continuous process Industries; **Applications:** Liquid storage & handling, gas sensing, biochemical reaction engineering, bulk liquid transport; **Market:** The global equipment market size is projected at a **CAGR** of **4.5%** during period of 2022-**2030.**

Intellectual Property

IITM IDF Ref.:892 ; Patent No. 302010

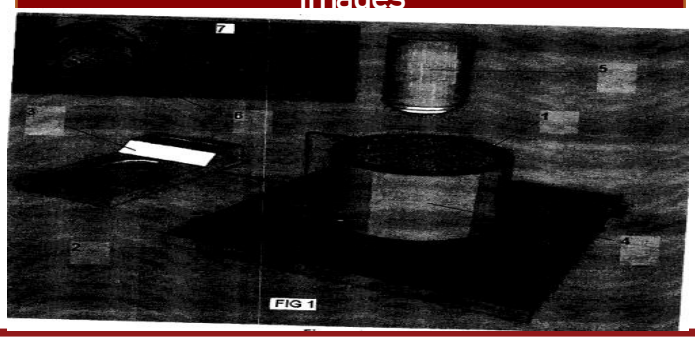
TRL (Technology Readiness Level)

TRL-3/4, Proof of Concept, tested& validated

Research Lab

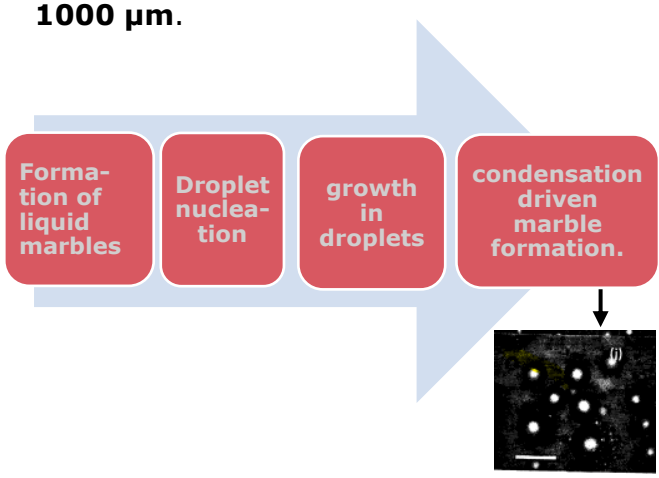
Prof. Mahesh Panchagnula,
Dept. of Applied Mechanics & Biomedical Engineering

Images



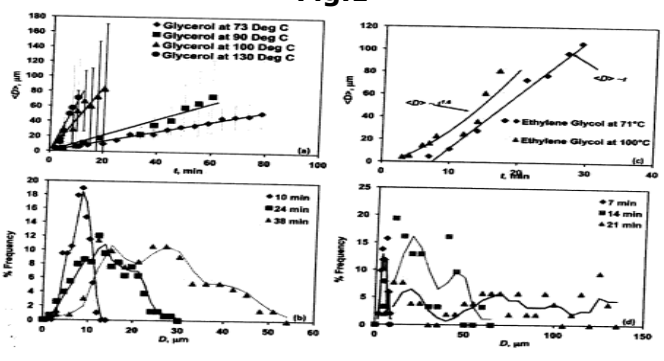
Technology

- Present invention describes a **method of condensation on a nanoparticulate matrix to continuously produce liquid marbles.** (Refer Smart Chart)
- Further, said process is driven by condensation on a nanoparticulate matrix to continuously **produce liquid marbles** whose **mean size can be controlled** in the range of diameters **from 3µm to 1000 µm**.



- The claimed process provides the **condensation-driven marble formation**, wherein the process is causing the formation of liquid marbles into droplet nucleation followed by growth driven by condensation. The simulation results are given hereinbelow:

Fig.1



CONTACT US
Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Industrial Consultancy & Sponsored Research (IC&SR)

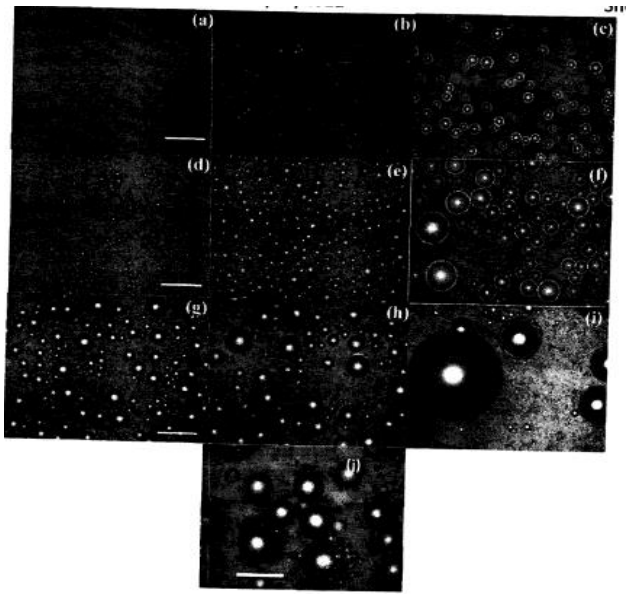
Technology

Said Process comprises a few steps of:

1. Spreading hydrophobic particulate material on a liquid free surface of a liquid contained in a container;
2. Droplet nucleation by heating the liquid in the container due to which liquid vapor released at the surface diffuses through the particulate matrix;
3. Droplet growth of liquid marbles by condensation with marble number density constant & further droplet growth of liquid marbles by collision coalescence;
4. Detecting size of liquid marbles & scooping out the desired size of liquid marbles on particulate material;
5. Removing the excess hydrophobic particulate material and/or transporting the liquid marbles using air stream,
6. Said particulate material matrix made of long chain nano particle chains of fumed silica that have been rendered hydrophobic by a silane surface treatment.

Outcome of proposed Method

Fig.2 : Illustrates optical micrographs of glycerol-nHMDS surface taken every 15min representing formation, growth, & coalescence of sweating marbles.



Key Features / Value Proposition

❖ *Technical Perspective:*

- The **nucleation rate of droplets** is dependent on the **number density of hydrophilic surface defects** of the **particulate material**.
- The hydrophobic particulate material is **HMDS nano particulate material.**
- Facilitates a **cost-effective flexible method** in terms of **condensation-driven marble formation process.**
- Said method of **nucleation, condensation and collision coalescence** of liquid droplets on a **nano particulate matrix made** of long chain nano particle chains of **fumed silica with hydrophilic chain** having **spots of untreated silica regions** which are hydrophilic to **continuously produce liquid marbles**.
- Produced liquid marbles are having controlled size in the range of **3µm to 1000 µm**.

❖ *Industrial Perspective:*

- Liquid marbles are applicable as **liquid storage, gas sensing, rapid, large scale biochemical reaction engineering, & bulk liquid transport**.
- In addition to this, **applicable** in the areas where **high viscosity liquids** need to be **transported.**

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IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719