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Better Catheter Design With Improved Liquid Flow Through Tubes

Tan Ta and Tsung-chow Su
Florida Atlantic University

For some postsurgical patients and stroke victims, a drainage bag is used to discharge urine. As a small and intermittent amount of urine drains down the small tube, urine needs to travel around the confined air bubbles that occupy the tube. As the urine squeezes through the gap between the air and the tube's wall, the air bubbles slowly rise and allow urine to travel downward. The resistance of such film flow is significant and the urine may become stagnant or backflow, resulting in painful pressure on a sensitive part of the body. Bacterial colonization of catheters is common. Each day of catheter use increases the chance for the appearance of bacteria in the urine by 5%. These infections can have serious consequences, including death. Infections can be prevented by maintaining a closed drainage system, keeping high infection control standards and by preventing backflow from the catheter bag. To prevent the backflow from the catheter bag in a closed drainage system will require the improvement of liquid flow through closed tubes in the presence of confined bubbles. This paper demonstrates the use of a tube with a superhydrophobic coating together with either angular cross section, embedded thin fins, or a spiral thread in order to improve the drainage under the aforementioned situations. Due to the superhydrophobic coating, the liquid will tend to stay away from the tube's surface and because of the angular geometry or other geometric modifications, liquid will not occupy these corner areas. As a result, liquid will tend to move in the central region of the tube while the air counterflow will use the passage near the corners. The outcome was impressive, with bubbles no longer obstructing the flow. Thus, the combination of the effect of modified cross section geometry and the hydrophobic coating will prevent the confined bubble from obstructing liquid flow in tubes. The applications to the improvement of urinary catheters design are discussed in this paper.

Assessment Of Antibiofilm Activity Of Magnesium Fluoride Nanoparticles-Stabilized Nanosized Emulsion After Its Coating On Biomaterial Surfaces

Tamilvanan Shunmugaperumal and Ramamurthy Srinivasan
International Medical University (IMU)

The use of surgically implanted or nonsurgically inserted medical devices has received an escalating interest in modern medical practices. Upon implantation or insertion into patient's body for exerting the intended purpose like salvage of normal functions of vital organs, the medical devices are unfortunately becoming the sites of competition between host cell integration and microbial adhesion. To control microbial colonization and subsequent biofilm formation onto the medical devices, different approaches either to enhance the efficiency of certain antimicrobial agents or to disrupt the basic physiology of the pathogenic micro-organisms, including novel small molecules and antipathogenic drugs, are being explored. In addition, the various lipid- and polymer-based drug delivery carriers are also investigated for applying antibiofilm coating onto the medical devices especially over catheters. The major objectives of this paper are as follows: (1) to synthesize magnesium fluoride (MgF_2) nanoparticles; (2) to prepare MgF_2 nanoparticle-stabilized oil-in-water (o/w) nanosized emulsion; (3) to coat biomaterial surfaces (glass coupons) with MgF_2 nanoparticles, and MgF_2 nanoparticle-stabilized emulsion; (4) to challenge the coated and uncoated glass surfaces with fresh bacterial cultures (i.e., *Escherichia coli* and Staphylococcus aureus) in 24-well plate over 18 h for biofilm formation; and (5) to compare the efficacy of emulsion-coated and emulsion-uncoated glass coupons in restricting the bacterial growth and biofilm formation.

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