Time & Location: March 31, 2010 at 11:00 AM in Eng. 1 307D  
Title: Particle Separation Through Taylor Couette Flow and Dielectrophoretic Trapping

As the world population approaches seven billion, a greater strain is put on the resources necessary to sustain life. One of the most basic and essential resources is water and while two thirds of the earth is covered by water, the majority is either salt water (oceans and seas) or it is too contaminated to drink. The purpose of this project is to develop a portable device capable of testing whether a specific source of water (i.e. lake, river, well...) is potable. There are numerous filtration techniques that can remove contaminants and make even the dirtiest water clean enough for consumption but they are for the most part, very time consuming and immobile processes. The device is not a means of water purification but rather focuses on determining the content of the water and whether it is safe. Particles within the water are separated and trapped using a combination of a Taylor Couette fluid flow system and Dielectrophoretic electrodes. This paper explores Taylor Couette flow in a large gap and low aspect ratio system through theory and experimentation with early stage prototypes. Different inner cylinder radii were tested at different speeds approaching, at and passing the critical Taylor number for each cylinder. Dielectrophoretic (DEP) electrodes were designed, fabricated, coated and tested using latex beads to determine the method of integrating them within the fluid flow system. Taylor Couette theory, in terms of the formation of vortices within the large gap, small aspect ratio system, was not validated during testing. The flow pattern generated was more akin to a chaotic circular Couette flow but still served to move the particles toward the outer wall. Fully integrated tests were run with limited success. Recommendations were made to pursue both circular Couette flow as the basis for particle separation and dimensional changes in the setup to allow for the formation of Taylor vortices by increasing the radius ratio but still allowing for a larger volume of fluid.

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Approved for distribution by Dr. Quanfang Chen, Committee Chair, on January 11, 2010.

The public is welcome to attend.