

***Public Abstract***

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***FLUORESCENT MOLECULAR ROTORS AS MECHANOSENSORS IN BIOFLUIDS***

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Abnormalities in blood plasma viscosity are seen in many pathologic conditions such as diabetes mellitus, severe hemorrhage, stroke, and endotoxemia. Although viscosity changes are not considered causes of these diseases, they can be used as markers to indicate presence or severity of disease, response to therapy, or in characterizing the disease process. Blood plasma proteins form a layer at the blood-air interface that inhibits accurate measurement of viscosity with instruments that determine viscosity from fluid shear stress. In addition, protein deposits at the instrument surface may cause erroneous readings and increases the time required for viscosity measurement. An instrument that could quickly and accurately measure viscosity of small quantities of blood, in succession, would greatly increase the utility of plasma viscosity measurement in the clinical setting. Molecular rotors, fluorescent dyes with viscosity-dependent quantum yield, have been used to monitor polymerization and as cell membrane fluidity sensors. The potential application of molecular rotors to measure fluid viscosity, without the application of shear, is particularly interesting with respect to recent developments in blood resuscitation medicine, where fast readout and low sample volumes are necessary. Molecular rotor fluorescence was studied in various solvents and biofluids to determine their usefulness as biofluid viscosity sensors. The precision of blood plasma viscosity measurement using molecular rotors was compared to the measurement precision of a state-of-the-art rheometer. The fluorescence sensitivity of surface-immobilized molecular rotors was also assessed to show the feasibility of a fiber-optic viscosity sensor.