Designing Piezoelectric Actuated Device for Blood Sampling

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In the present study, design aspects of piezoelectric actuated device used for extraction of blood sample is presented. A pentagonal microneedle, which is an integral part of the device, is used to extract the blood volume. The blood is then delivered to the biosensor, located in the device, for diagnosis. The purpose of such low-powered devices is to get sufficient blood volume for the diagnostic purpose at the biosensor location with minimum time of actuation, which will eventually cause less pain. For the same, design modifications are carried out to obtain enhanced directional flow at a reduced frequency and excitation voltage to the piezoelectric bimorph actuator. Simulations performed on four quarter piezoelectric bimorph actuator (FQPB) works on the 2.5 volts. The model and harmonic analysis are carried out with various load conditions for FQPB. The first natural frequency and deflection at 2.5 volts are obtained at 35338 Hz and 3.2 µm respectively. The extended microneedle lengths inside the pump chamber showed improved flow characteristics and enhanced volume flow rate. The volume flow rate at the first natural frequency (35338 Hz) for 2.5 volts is measured 1.758 µl/sec in the biosensor location. Then the applied frequency is reduced to 22000 Hz to obtain the 1.256 µl/sec at biosensor location, which is just more than the required volume of 1.1 µL.