A Water Powered Micro Drug Delivery System

Shyla Booker
ELE 482 Biomedical Engineering Seminar III

Drug delivery covers a broad range of technologies to transport therapeutic agents into human bodies. The most common drug delivery methods today including oral or hypodermic injection generate a high concentration right after the drug is delivered and a low concentration before the next dose is delivered. Controlled drug delivery systems offer benefits over repetitive administrations of conventional drug delivery methods by providing unattended and continuous delivery. By avoiding significant concentration fluctuation controlled drug delivery systems can result in enhanced drug efficiency and minimized side effects. These systems can also provide alternative paths to deliver special drug components such as proteins and peptides which are often difficult to administrate due to rapid degradation and poor absorption in the gastrointestinal tract. Another example is macromolecules such as genes which are difficult to deliver by other techniques.

A plastic micro drug delivery system has been developed that utilizes the principle of osmosis without any electrical power consumption. The system has an osmotic microactuator and a polydimethylsiloxane (PDMS) microfluidic cover compartment consisting of a reservoir, a microfluidic channel and a delivery port. The typical dimension of the microfluidic channel is 1cm in length with a cross-sectional area of 30 x 100um^2 . Using oxygen plasma to activate the surfaces of polymers for bonding, the osmotic actuator is bonded with the PDMS cover while liquid drug can be encapsulated during the bonding process. The prototype drug delivery system has a measured constant delivery rate at .2uL/h with a delivery volume of 2 uL. The induced osmotic pressure can be as high as 25 MPa to overcome possible blockages caused by cells or tissues during drug delivery.

In the future, this system could be integrated with control and sensing units to become a smart system for versatile drug delivery.