

Drug Delivery Based on Micro Electro-Mechanical Systems: A Review

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Abstract

The aim of controlled drug delivery is to manage the time and site of drug release according to the patients' need. In this paper, Micro Electro-Mechanical Systems (MEMS) technology is described. This technology employs microelectronics and microprocessor circuits in order to reach individualized, targeted and controlled drug release and would construct the future drug delivery systems.

Introduction: Controlled drug delivery systems are the state of the art in drug delivery technology with the goal of controlling the drug release at right time and site to satisfy the patient's pathophysiological requirements. In spite of great improvements in this field, it still remains an open research area. MEMS employs sophisticated systems in a small scale. In last few decades, this technology has increasingly attracted the researchers' attention due to its successful miniaturization of complicated drug delivery systems to address unmet dosing requirements more precisely. MEMS drug delivery systems are fabricated using the microelectronics and microprocessor circuits of highly-advanced technology. This provides the opportunity to implement several drug reservoirs and billions of electronic devices in few millimeters.

Methods and Results: In this study, MEMS technology is introduced along with describing the fabrication process. Two main categories of MEMS devices including internal and transdermal devices and their applications in drug delivery systems are presented. Various actuators applied in these devices are described, including electrical, electrochemical, electromechanical, and electrothermal types. Finally, emerging technologies and prospects are briefly reviewed.

Conclusions: MEMS techniques can be easily combined with microprocessors and sensors to implement an intelligent system which can determine the proper drug dosage and release time according to the signals received by biosensors. When placed inside the body, biocompatibility and biofouling issues should be well-considered, since the device will remain in the patient's body for a long time. Therefore, MEMS technology seems to be the future aspect of targeted drug delivery systems.

Key words: Micro Electro-Mechanical Systems (MEMS), targeted drug delivery, actuator, internal device, transdermal device