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Glucose: Responsive release of insulin

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The World Health Organization (WHO) estimated the number of diabetic patients would increase from 250 million people today to 380 million by 2025. Today, about half million Emiratis suffer from diabetes and about half a million in pre-diabetic stage. Insulin dependent diabetic patients desire effective and convenient therapeutic options. Huge research investment has been made to develop insulin delivery systems for diabetic patients. The existing delivery systems (injection, oral, inhalation) for insulin all suffer from the inability to regulate insulin without patient intervention. There is a pressing demand to produce self-regulating insulin delivery system that takes the monitoring of insulin release away from the end-user, particularly for diabetic young patients. A delivery system that meets the on-demand insulin release was reported, however it was based on toxic lectin (Con-A), which limited its application for diabetic patients. In here we describe a novel nano-system for insulin delivery that is regulated by glucose concentration. Insulin is entrapped by a non-toxic nanostructures that has affinity to glucose, once the glucose concentration reaches above the therapeutic range the insulin will be released, thus maintaining a therapeutic glycemic levels. The insulin release polymer is prepared by copolymerizing acrylic acid with different concentrations of 3- methacrylamidophenylboronic acid (MAAPBA). The loading capacity and release of the loaded insulin at different concentrations of glucose under physiological pH were studied. The release of insulin, in response to a glucose dose, from the insulin-loaded polymer is dependent on the composition between acrylic acid and MAAPBA. With increase in concentration of 3-methacrylamidophenylboronic acid, the glucose responsive insulin release from poly(acrylic acid-co-methacrylamidophenylboronic acid) polymer at the physiological pH of 7.4 was enhanced. The presence of glucose resulted in disintegration of the polymer leading to release of the loaded insulin. With increase in the MAAPBA, the insulin loading capacity of the polymers decreased, but their sensitivity to glucose increased. This resulted in better release of loaded insulin corresponding to the glucose concentration in the solution at physiological pH of 7.4.

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