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Dissolving microneedles for the delivery of therapeutics

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The application of nanotechnology in health sciences has experienced an exponential growth over the last 25 years with special focus on drug delivery systems. Transdermal delivery has recently gained importance for its numerous advantages, which include sustainable release, bypass of the pre-systemic hepatic metabolism and patient compliance. Microneedles are designed to circumvent the skin barrier to enhance transdermal drug delivery. They have been produced in various geometries (cone, cylinder, triangular prism, etc) and materials such as silica, polymers or metals. Microneedles made from sugars or water soluble polymers are dissolvable in the skin and release the drug cargo leaving no sharp waste behind. Moreover, polymer microneedles can incorporate larger drug load than other type of needles such as coated or hydrogel swelling microneedles. These dissolving microneedle arrays have been applied in various pharmacological sectors such as gene therapy, vaccine delivery or drug delivery. However, there is still a need of clinical and pre-clinical research before these devices can be released into the market. An essential challenge is to tailor the microneedles dissolution rate to control the release of therapeutics irrespective of the polymeric material. There is also a need to reduce the risk of skin infections during the insertion as microneedles create small pores on the skin. Our research focuses on the development of plasma polymerized surface engineered microneedles for a controlled dissolution and controlled drug release. This one-step, environmental friendly and substrate independent technique will also ease the industrial manufacture. Furthermore, these surfaces can be functionalized to confer antibacterial properties to our microneedles patches to hinder infections and skin damage.

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