ENZYME IMMOBILIZATION ON TEXTILES BY INKJET PRINTING FOR ADVANCED APPLICATIONS

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ABSTRACT

Immobilization of enzymes on textiles can impart a range of advanced applications e.g. anti-microbial, controlled release, drug delivery and bio-sensing. Such applications enable minimal consumption, recovery, and reusability of these valuable bio-materials compared to their conventional textile applications in surface cleaning and finishing. Methods used for immobilization can play important roles to ensure precise, flexible and contamination free application. Compared to many of the conventional methods of textile immobilization such as coating and screen-printing, digital inkjet technology offers many benefits for such advanced applications. Among various inkjet technologies, drop-on-demand piezoelectric printing is a promising resource-efficient technology for enzyme immobilization.

The enzymes should retain high activity after immobilization process. Various factors involved during inkjet printing and fabric characteristics can influence this enzymatic activity. Factors concerning inkjet procedure include rheology and ionic nature of ink along with shear force and waveform generated inside a piezoelectric printhead. Factors dependent upon fabric characteristics include surface structure, pore size distribution, and binding mechanism. In this work, we have studied the effects of inkjet procedures on enzymatic activity. Lysozyme being a stable and well-studied enzyme was chosen for our experiments. A Xennia Carnelian printer with a Dimatix QS10 industrial printhead was used for inkjetting. Lytic activity of lysozyme was studied by a UV-Vis spectrophotometer against a decrease of Micrococcus lysodeikticus cell concentration at 450 nm. Results showed ca. 10-15% activity reduction of the jetted lysozyme ink. As all the ink and printer parameters were optimized, the probable reason for such reduction could be the effect of shear force inside printhead on the three-dimensional conformation of lysozyme. In conclusion, our formulated lysozyme ink showed potential for printing textiles with probable activity reduction that require further investigation.