Direct immobilization of DNA probes on non-modified plastics by UV irradiation and integration in microfluidic devices for rapid bioassay

DNA microarrays have become one of the most powerful tools in the field of genomics and medical diagnosis. Recently, there has been increased interest in combining microfluidics with microarrays since this approach offers advantages in terms of portability, reduced analysis time, low consumption of reagents, and increased system integration. Polymers are widely used for microfluidic systems, but fabrication of microarrays on such materials often requires complicated chemical surface modifications, which hinders the integration of microarrays into microfluidic systems. In this paper, we demonstrate that simple UV irradiation can be used to directly immobilize poly(T)poly(C)-tagged DNA oligonucleotide probes on many different types of plastics without any surface modification. On average, five- and fourfold improvement in immobilization and hybridization efficiency have been achieved compared to surface-modified slides with aminated DNA probes. Moreover, the TC tag only costs 30% of the commonly used amino group modifications. Using this microarray fabrication technique, a portable cyclic olefin copolymer biochip containing eight individually addressable microfluidic channels was developed and used for rapid and parallel identification of Avian Influenza Virus by DNA hybridization. The one-step, cost-effective DNA-linking method on non-modified polymers significantly simplifies microarray fabrication procedures and permits great flexibility to plastic material selection, thus making it convenient to integrate microarrays into plastic microfluidic systems.