Preliminary study on high-density self-assembled beads microarray technology for high-throughput aptamer screening

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Aptamers are DNA/RNA oligomers which bind to their target molecule with very high affinity and specificity. In recent years it has been reported that aptamers due to their many advantages such as chemical synthesis, reversible denaturing, small size, immunogenicity and others over antibodies, they have the capacity to replace antibodies as the tool for therapeutic diagnostic purposes [1]. Conventional method employed for aptamer synthesis is Systematic Evolution of Ligands by EXponential enrichment i.e. SELEX. However in SELEX screening of aptamers are influenced by the presence of other aptamer candidates which reduces the probability of selection of highest affinity aptamer from the candidate library. Microarray may provide an alternative high-throughput screening platform for high efficiency aptamer as it enables a) parallel and direct screening of large candidate libraries of DNA oligomers b) one-on-one screening of each candidate oligomer with target molecule screening higher specificity aptamers. The aim is to develop $10^6$-$10^7$ per cm$^2$ microwell array chip using DNA on-bead technology. DNA (candidate aptamers) is immobilized on beads using emulsion PCR technique and are distributed on chip using magnetic field [2]. Aptamer candidates are reacted with fluorescently labelled target protein. Affinity of each DNA oligomer against target molecule is individually evaluated. Higher is the fluorescence shown by the beads higher is the affinity of DNA that is immobilized on bead, with respect to target molecule. Therefore, in microarray technology screening of aptamers is independent of the comparative concentration of each DNA oligomers in the reaction mixture providing solution to the problem associated with the conventional method of aptamer screening.

References:

Figure: (a) At 40X magnification: Comparison between fluorescence intensity of microarray plates having only aptamers immobilized beads, without aptamers beads and the ratio of beads having aptamers & beads without aptamers in 1:1 ratio. (b) At 10X magnification: 1:1 ratio of magnetic beads with and without aptamer.