ELECTRON BEAM PLASMA MODIFICATION OF MICROTITRE PLATES FOR COVALENT BIOMOLECULES IMMOBILIZATION*

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Microtitre plates are effective solid-phase platforms for multiplexed, high-throughput screening and analysis of biomolecule interactions. This multi-well format is widely used in both industry and medical fields due to its ease of automation, high capacity for paralleled data collection, and versatile application of technologies (e.g., proteomics, functional genomics, biomolecule separation and purification). Microtitre plates made of polystyrene are most commonly employed because they readily adsorb (via non-specific adsorption) proteins, have excellent optical as well as mechanical properties, and are cost-effective. However, several of these intrinsic properties of polystyrene also present disadvantages: poor chemical resistance, difficulty controlling surface chemistry, protein denaturation, desorption and/or loss of biomolecule activity. Indeed, it has been estimated that less than 10% of adsorbed protein molecules retain their activity.

Electron beam plasma treatment was applied to activate the polystyrene microtitre plates surface and thus to facilitate covalent biomolecule immobilization. Electron beam generated plasmas constitute a unique class of plasmas due to their intrinsic low electron temperatures (< 1 eV), plasma potentials and thus ion kinetic energies. For the treatment of polymers, these plasmas have demonstrated the ability to change the surface energy and chemistry with limited change in surface topography and low etch rates.

In this wore, we have taken standard hydrophobic microtitre plates costing ~$3 each and converted them to versatile immobilization platforms capable of covalent attachment chemistry; commercial pre-activated plates typically cost $15 to $25 each. This approach allows for variation of the chemical moiety on the surface, as well as the crosslinker used to attach the biomolecule. Furthermore, the user is able to define the conditions used for immobilization, further expanding the numbers and types of molecules that can be used in microtitre assays.

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