Design, synthesis and characterization of Polyoxometalates for use as electrochemical labels for detection of single nucleotide polymorphisms using electrochemical array based primer extension

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Polyoxometalates (POMs) are anionic nanometre sized metal-oxygen clusters exhibiting great diversity in nuclearities, sizes, shapes and rich electrochemical property. Although these classes of compounds have been known for almost two centures, their fascinating properties and applications ranging from catalysis to medicine are the driving forces for the increasing attention in the past two decades due to added value properties (tunable redox properties, large size, high negative charges and nucleophilicity).

We have designed, synthesized and characterized POMs functionalized DNA for use in genosensors and electrochemical APEX. We synthesized two families of POMs; Dawson (subnanometer sized) and Keggin (sub Angstrom size) derivatives. We coupled POMs with amine terminated synthetic DNA following generic amine coupling protocols. In addition, copper mediated 1,3 cycloaddition (Click reactions) have also been utilized for the first time to click POMs to alkyne bearing PCR products and alkyne terminated forward primer. We also coupled deoxynucleotide triphosphates (dNTPs) and dideoxy nucleotides (ddNTPs) with POMs. The former will be used for studying the enzymatic incorporation of POM modified nucleotides for direct detection using electrochemical genosensors while the latter will be used for electrochemical APEX using POMsThe modified POMs were characterized using attenuated total reflection infrared spectroscopy, Raman spectroscopy, NMR, ESI-MS and the unique electrophoretic migration of POMs in agarose gel was investigated.