Understanding peptide sequence selectivity on iron sulfide (FeS) nanoparticle surfaces

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The emergence and evolution of functional biopolymers on Earth is one of the unsolved key questions regarding the origin of life. Amongst various building blocks of polymers, amino acids are prebiotically abundant and different plausible paths toward forming polypeptides have been previously shown in the context of early Earth environment. However, relationship between a specific geochemical environment and the types of biopolymers that could retain or to propergate in that condition is not yet fully systematically explored. Hence, we have prepared random octapeptide library with a combination of limited set of amino acids (Gly, Ile, His, Asp, Cys, Arg) as a probe to explore the sequence selectivity of iron sulfide (FeS) nanoparticles as a simulant of the geochemical settings that once existed at the deep-sea floor or the surface of early Earth. Experiment was carried out by mixing the FeS nanoparticles and random peptides in pure H_2O solution inside the anoxic chamber to allow adsorption under moderate temperature/pH condition. After extensive rinsing step, peptides that remain bound to the FeS nanoparticles were analyzed directly by MALDI-MS/MS to retrieve sequence information. We will discuss the latest sequence results obtained from screening and discuss sequence selective feature of FeS and its relevance to the iron-sulfur cluster known as a fundamental cofactor in biology.

Keywords: Iron sulfide, peptide adsorption, MALDI-MS/MS, iron-sulfur cluster

