Geophysical Research Abstracts,
Vol. 11, EGU2009-8614-1, 2009
EGU General Assembly 2009

The SOLID (Signs Of LIfe Detector) instrument concept: an antibody microarray-based biosensor for life detection in astrobiology

V. Parro (1), L.A. Rivas (1), J.A. Rodríguez-Manfredi (1), Y. Blanco (1), G. de Diego-Castilla (1), P. Cruz-Gil (1), M. Moreno-Paz (1), M. García-villadangos (1), C. Compostizo (2), P.L. Herrero (2), and the SOLID Team

(1) Centro de Astrobiologia (INTA-CSIC), Torrejón de Ardoz, 28850, Madrid, Spain (parrogv@inta.es/ +34-915201074), (2) SENER Ingeniería y Sistemas S. A. Avda. Zugazarte 56, 48930, Las Arenas, Vizcaya, Spain

Immunosensors have been extensively used since many years for environmental monitoring. Different technological platforms allow new biosensor designs and implementations. We have reported (Rivas et al., 2008) a shotgun approach for antibody production for biomarker detection in astrobiology and environmental monitoring, the production of 150 new polyclonal antibodies against microbial strains and environmental extracts, and the construction and validation of an antibody microarray (LDCHIP200, for “Life Detector Chip”) containing 200 different antibodies. We have successfully used the LDCHIP200 for the detection of biological polymers in extreme environments in different parts of the world (e.g., a deep South African mine, Antarctica’s Dry valleys, Yellowstone, Iceland, and Rio Tinto). Clustering analysis associated similar immunopatterns to samples from apparently very different environments, indicating that they indeed share similar universal biomarkers. A redundancy in the number of antibodies against different target biomarkers apart of revealing the presence of certain biomolecules, it renders a sample-specific immuno-profile, an "immnuno-fingerprint", which may constitute by itself an indirect biosignature. We will present a case study of immunoprofiling different iron-sulfur as well as phylosilicates rich samples along the Rio Tinto river banks.

Based on protein microarray technology, we designed and built the concept instrument called SOLID (for “Signs Of LIfe Detector”; Parro et al., 2005; 2008a, b; http://cab.inta.es/solid) for automatic in situ analysis of soil samples and molecular biomarkers detection. A field prototype, SOLID2, was successfully tested for the analysis of grinded core samples during the 2005 “MARTE” campaign of a Mars drilling simulation experiment by a sandwich microarray immunoassay (Parro et al., 2008b).

We will show the new version of the instrument (SOLID3) which is able to perform both sandwich and competitive immunoassays. SOLID3 consists of two separate functional units: a Sample Preparation Unit (SPU), for ten different extractions by ultrasonication, and a Sample Analysis Unit (SAU), for fluorescent immunoassays. The SAU consists of ten different flow cells each of one allocate one antibody microarray (up to 2000 spots), and is equipped with an unique designed optical package for fluorescent detection. We demonstrate the performance of SOLID3 for the detection of a broad range of molecular size compounds, from the amino acid size, peptides, proteins, to whole cells and spores, with sensitivities at the ppb level.

References

Parro, V., et al., 2005. Planetary and Space Science 53: 729-737.
Parro, V., et al., 2008a. Space Science Reviews 135: 293–311
Parro, V., et al., 2008b. Astrobiology 8:987-99
Rivas, L. A., et al., 2008. Analytical Chemistry 80: 7970–7979