Geophysical Research Abstracts
Vol. 13, EGU2011-1449-1, 2011
EGU General Assembly 2011

SOLID3: A Biochip-Based Instrument for Environmental Monitoring in Planetary Exploration

Graciela De Diego, Víctor Parro, José A. Rodríguez-Manfredi, Luis A. Rivas, Yolanda Blanco-López, Eduardo Sebastián, Julio Romeral, Carlos Compostizo, Pedro L. Herrero, Adolfo García-Marín, Mercedes Moreno-Paz, Miriam García-Villadangos, Patricia Cruz-Gil, Verónica Peinado, Javier Martín-Soler, Juan Pérez-Mercader, and Javier Gómez-Elvira

Centro de Astrobiología (INTA-CSIC), Carretera de Ajalvir km 4, Torrejón de Ardoz, 28850, Madrid, Spain; 2SENER Ingeniería y Sistemas S. A. Avda. Zugazarte 56, 48930, Las Arenas, Vizcaya, Spain (diegocg@inta.es)

Immunosensors have been extensively used since many years for environmental monitoring. Based on protein microarray and lab on-a-chip technologies, we have designed and built a series of instruments called SOLID (for "Signs Of LIfe Detector") (Parro, V., et al., 2005) for automatic in situ detection and identification of microbial remains, substances or analytes from several solid (soil, sediments, powder...) or liquid samples (Parro .V et al , 2008). Antibody microarrays permit the attachment of a myriad of different immunoglobulin to perform assays on a single chip in an ultra-high-throughput and miniaturized format to detect multiple different compounds. Herein we show the SOLID V3.0 instrument, which is able to perform both sandwich and competitive immunoassays and 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. Our system includes all the mechanisms, detectors and electronics needed to automatically operate and collect results. The SAU unit consists of five different flow cells, having only one antibody microarray in each one. The microarray has the capacity for 2000 reaction spots on its surface. This unit is also equipped with an exclusive optical package and portable CCD device for fluorescent "in situ" detection. We demonstrate the performance of SOLID3 for the detection of a broad range of molecular size compounds, from peptides, proteins, to whole cells and spores, with sensitivities at ppb (ng ml-1) level for biomolecules and 104-105 units per ml-1 for spores and bacterial cells. SOLID instrument, together with its core biosensor, the LDCHIP300 (a 300 antibody containing Life Detector CHIP) (Rivas LA, et al, 2008), has been tested for environmental studies in different field campaigns in terrestrial analogues like Río Tinto (Spain), Atacama subsurface (Chile) and Antarctica. Our SOLID instrument concept is an excellent option to become part of the payload for future missions to explore the Solar System.

References

• Parro, V., et al., 2005. Instrument development to search for biomarkers on Mars: Terrestrial acidophile, iron-powered chemolithoautotrophic communities as model Systems. Planetary and Space Science 53: 729-737

• Parro .V et al , SOLID2: an antibody array-based life-detector instrument in a Mars Drilling Simulation Experiment (MARTE). 2008 Astrobiology 8: 987-999

• Rivas LA, et al, 2008.A 200-antibody microarray biochip for environmental monitoring: searching for universal microbial biomarkers through immunoprofiling. Analytical Chemistry 80(21):7970-9