

Mapping Proteins: The 2-D Electrophoresis Issue

Kevin McAloon

The discovery of different proteins is vital in the biopharmaceutical world. Discovering how proteins act, react, and interact can mean advances that cure diseases. Proteomics researchers study issues such as the characteristics of a crop, the environment in which it can grow, and the divergent properties of different species. The development of proteomics has been enabled and enhanced by advances made in laboratory analysis methods including isoelectric focusing and 2-D electrophoresis.

The 2-D electrophoresis process separates molecules using an electric field across a strip or a gel. This process is used to identify and characterize individual molecules according to their discreet electric charges. By putting a sample into a gel and subjecting it to an electrical charge, a scientist can break down the different characteristics of a gene or protein.

Unfortunately, the original process of 2-D electrophoresis was not problem-free. It was costly and time-consuming, and the instruments were oversized and cumbersome, taking up a lot of bench space. Older electrophoresis models accepted low voltage (< 3,500 V), lengthening the separation process time, and they used huge quantities of mineral oil to reduce water evaporation. Samples were easily contaminated because of the amount of handling required. With those issues in mind, researchers began developing a machine that would be cost-effective and fast, while providing enhanced results.



Researchers looked for a solution that addressed all the issues. Scientists at Amersham BioSciences (www.amershambiosciences.com) came up with some innovations. Their first improvement was to develop precast, immobilized pH gradient (IPG) polyacrylamide gel strips to hold samples within the system without contamination. The gradient gels contained the sample, but they needed a strip-holder to contain the gel. It would have to be thermally conductive and made of a material that would not contaminate the sample. The researchers studied ceramic as a material for the strip-holders.

Aluminum oxide ceramic cools uniformly and does not distort the protein pattern in the gel. Ceramic effectively conveys heat to the main instrument from the gel within the strip holder. The Amersham scientists got help in enhancing the strip holders from Morgan Advanced Ceramics.

The ceramic holders were not an immediate success because the natural surface properties of ceramic can interfere with protein solution separation. Scientists

from the two companies worked together to create a proprietary surface treatment that made the material hydrophobic.

The groundwork was laid to begin developing a new, more effective system. The resulting IPGphor electrophoresis system is compact, allowing for more space in the laboratory. The platform serves as an electrical connector and thermal control system that can apply up to 8,000 volts of electricity for a faster, more cost-effective product. The new design reduces the use of mineral oil and thus product waste. The system also offers a cooling feature, which helps to speed up the protein separation process.

2-D electrophoresis is now a much simpler process, with quick results and enhanced resolution and reproducibility to help further advancements in proteomic research. **AA**

Kevin McAloon is the applications engineering manager of Morgan Advanced Ceramics, 26 Madison Road, Fairfield, NJ 07004, 973.227.8877, fax 973.227.7135, KMcaloon@mac-na.com, www.morganadvancedceramics.com.