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NASA TECH BRIEF

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Methods for Improved Resolution of Flow Electrophoresis Cells

One basic factor affecting the resolution of particle streams in electrophoresis flow cells is the zeta potential. This potential results from ions that are adsorbed on the surfaces of the cell walls, and interfere with the electric field sensed by the migrating particles. The net effect is poor resolution or separation among different particle species. However, each particle of a given species has a similar zeta potential produced from the surrounding hydrated sphere. If the zeta potential of the cell wall can be made to match those of the particles, the interference from the cell walls could be reduced considerably, enhancing the resolution. Wall coatings that could provide desired zeta potentials are usually incompatible with electrophoretic equipment.

Three approaches have been developed to improve this resolution. One method involves a remotely-adjustable zeta potential. In this technique, an adjustable high-voltage electrical field is provided by two metal plates located, respectively, above and below the large faces of the electrophoresis cell. The electric field established by these plates is perpendicular to the faces and also to the direction of particle flow. By the proper adjustment of electrical field magnitude and sign, the cross sections of particle streams are compressed and centered. As a result of these reduced-flow cross sections, particle streams of different species become more separated, yielding improved resolution.

The second method, similar to the first, produces essentially the same effect. In this scheme, two conducting metal plates are sandwiched between the opposite cell walls, and a thin insulating layer. The opposing thin layers become part of the interior cell wall. A positive or a negative potential applied to either plate induces a charge of opposite sign on its interior insulator. Again, by regulating the sign and the magnitude of the applied potential, the induced charge increases or decreases the effective wall zeta potential.

The third method entails a counterflow buffer. In this case, the buffer is forced to flow in a direction opposite to the particle streams. The counterflow separates the particle streams, effectively reducing the normal time required for this separation. The result is improved resolution among the particle streams per given cell length.

Notes:

1. Either one of the first two methods may be used in conjunction with the counterflow technique to improve the resolution further.
2. Requests for further information may be directed to:
   Technology Utilization Officer
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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:
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