Chiral separation with micro-flows

Potential benefit for the pharmaceutical industry

How do you separate enantiomers without any kind of chiral recognition between molecules? The answer seems to be fluidic channel simulations run by scientists in Germany and Sweden, particles will move to different regions of the channel according to their chirality. Once there, they will migrate at different speeds, and thus be separated. The researchers say that this approach could lead to significant benefits in the pharmaceutical industry, where chiral separation plays a significant role in drug design.

Chiral molecules are not identical to their mirror images - the two mirror images are enantiomers of each other. Chirality is common in living organisms - your hands, for example, are chiral - but it is of particular significance in pharmaceutical development: one enantiomer may have a therapeutic effect while the other is toxic.

Chiral particles are commonly separated using chemical methods, such as liquid chromatography or capillary electrophoresis, in which an auxiliary selector molecule is developed that can differentiate between the two enantiomers. There has been increasing interest in recent years, however, in physical separation methods that do not require chiral recognition.

Team member Friederike Schmid at the Johannes Gutenberg University in Mainz, Germany, says that the new approach is complementary to chemical methods. "The separation principle is expected to work for any pair of chiral molecules," she says. "Moreover, it also works if only small samples are available, it does not consume parts of the samples, and it can be integrated into a lab-on-a-chip device."

She adds: "A separation method based on physical principles is more generally applicable than one based on specific chemical reactions."

David Lathbury, vice president of chemical development at US contract research and manufacturing company Albany Molecular Research, welcomes the team's proof-of-principle discovery but cautions that the new approach faces stiff competition from established separation techniques. "We already have many ways to make chiral drugs enantioselectively pure", he says. "There isn't a general process for obtaining chiral molecules so if this is one then it could offer a cheap alternative. However, one would have to be cautious about things like capital cost. Some existing methods can be very cheap and are unlikely to be supplanted." Simon Perks

REFERENCE

Challenging nanotube consensus

Sides and ends support fast electron transfer too

UK scientists have shown that the sidewalls and closed ends of carbon nanotubes can support fast electron transfer, challenging the belief that these areas are electrochemically inert.

Carbon nanotubes (CNTs) have wide ranging electrochemical applications for sensing and energy. Forests of vertically aligned CNTs have been proposed for use as electrodes, but it was thought that the inert sidewalls would have to be insulated and the ends opened to allow electron transfer.

Scientists from the University of Warwick have now challenged this position by showing that the sidewalls and closed ends of CNTs can support fast electron transfer. Julie Macpherson, Patrick Unwin and co-workers used chemical vapour deposition to grow dense forests of pristine closed-end CNTs. They then applied a new nanoscale technique to investigate specific sites on CNTs within the forest. The technique uses a tiny electron microscope to examine specific points on individual carbon nanotubes for things like electrical charge and redox activity.

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As well as being of fundamental interest for understanding CNTs' electrochemistry, the finding opens up the potential for CNTs of any configuration to be used as electrodes, and means that they do not have to be modified, such as having the ends opened. "We hope that this will get people thinking differently about the electrochemistry of carbon nanotubes and appreciate that the whole surface can transfer electrons very efficiently," says Macpherson.

"This is a very interesting and exciting paper," commented Gareth Keeley, an expert in the electroanalytical applications of CNTs from Trinity College, Dublin, Ireland. He is concerned, however, that the debate over the electrochemistry of CNTs will rage a while longer, feeling that the 'claim to overturn the consensus on the importance of open ends is unlikely to gain wide acceptance until the same results can be demonstrated using inner-sphere redox probes'.

Macpherson and Unwin's team is now working on very sensitive electrochemical sensors composed of low-density planar nanotubes on insulating surfaces. Catherine Phidmore

REFERENCE

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