Creating a chiral polymer from achiral monomers using a magnetic field

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A combined team of researchers from the Weizmann Institute and the Israel Institute of Technology, both in Israel, has developed a way to create a chiral polymer from achiral monomers using a magnetic field as a way to align the spin of the electrons that are involved in bond formation. In their paper published in the journal Science Advances, the group describes their technique and possible uses for it in spintronics.

The work by the team involved placing a monomer molecule on an electrode and altering the direction of the flow of the current beneath it as a means of controlling the magnetic field on the electrode surface as additional monomers were added. Doing so allowed for spin-polarized electrons to be controlled as they were absorbed up into the body of the molecule, and that allowed for manipulating the shape of the polymer as it grew. The result was a chiral polymer with a desired shape.

The researchers note that they were able to maintain the “handedness” of each new stereocenter throughout the process, though they acknowledge that such control grew weaker as the polymer chains grew in length (which made them more distant from the electrode). Even so, they found that they were able to control the action at distances up to 100 nm.

Using the new technique, the researchers note, could allow for the production of chiral polymers without the need for chiral catalysts or even chiral reagents, which are typically discarded after the reactions are complete, representing a reduction in waste and cost. They suggest it might also lead to helping explain why molecules in living creatures are almost all single enantiomers.

More information: Deb Kumar Bhowmick et al, Spin-induced asymmetry reaction—The formation of...

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