Treating Iron Overload with Block Copolymers

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Technology description

Iron overload or hemochromatosis is a disease marked by an accumulation of iron in the blood. It typically occurs in subjects (e.g., anemia patients) receiving chronic infusions of red blood cells. The disease is estimated to afflict up to six percent of people in the United States, and can cause tissue damage or organ failure if not properly treated.

The most common drug for treating iron overload via the intravenous route is deferoxamine, which can chelate to both the Fe^{2+} and Fe^{3+} ions. Unfortunately the drug suffers from a poor half-life and dangerous side effects. Two more recent drugs, deferasirox and deferiprone, are more bioavailable as oral formulations but for reasons not well understood, they each preferentially bind to only one form of the ion and are currently being investigated in combination with each other or with deferoxamine to improve therapeutic efficacy. UW–Madison researchers have developed new block copolymers for forming micelles that can respond to the oxidation state of their environment and chelate iron (II) and (III) ions. At suitable concentrations the copolymers can form micelles to prolong circulation in the blood and bind to non-transferrin bound iron. The micelles then break up in cells in the presence of oxidizing agents such as hydrogen peroxide and are cleared from the body by the liver or kidney route.

The copolymers include a polyhydroxamic acid-containing block and a polyferrocenyl block. They can be prepared by standard peptide synthesis or polymerization methods.

Application area

New therapeutics for treating iron overload

Advantages

Large molecular structure offers improved pharmacokinetics.
Longer half-life
Efficient iron removal
Prepared by standard methods
Flexibly administered (oral, rectal or parenteral)

Institution

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