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Gels can work wonders, University researcher says

The inexpensive gelatin used in making jelly may someday be turned into magic "bullets" which can release encapsulated medicine as and when required inside the human body, according to Dr. Wu Chi at the Chinese University of Hong Kong.

Dr. Wu's pioneering research into the molecular properties of polyelectrolyte gels -- which is present in jelly, hair-styling gels, sea cucumbers and soft contact lenses -- has won competitive funding of HK$546,000 from the Research Grants Council in 1993.

"The enormous power of polyelectrolyte gels as an absorbent, coupled with their mysterious properties in expansion and contraction, have found wide applications in the medical, industrial and chemical fields," said Dr. Wu, of the Department of Chemistry.

Polyelectrolyte gels are, for instance, the key absorbent in nappies. Used in soil modification, they can ensure gradual release of water and fertilisers to facilitate plant growth.

According to Dr. Wu, scientists around the world are racing to unveil, at the molecular level, the secrecy surrounding these "exotic" gels -- which deviate from the three normal states of matter, and are neither solid, liquid nor gas.

As scientists see it, polyelectrolyte gels are in fact a special kind of macromolecules which, by developing branches and intermolecular connections, can form a three-dimensional network.

Such networks can collapse into rather tight structures (like jelly powder before water is added); but if water is added to fill up the space between the network, it can swell up and form gels.

Those polyelectrolyte gels that undergo "phase transitions" can have sudden changes in volume -- ranging from 100 to 500 times of their original size -- in response to slight changes in temperature, salinity, acidity and other factors. It is as if these gels would perform tasks on demand, hence the name -- intelligent gels.

Dr. Wu's research focuses on the deeper understanding of the "phase transition", and its relationship with the gel structure, so that various types of intelligent gels can be tailored and engineered for different applications in a cost-effective way. His findings have been published in eight articles in international scientific journals.

The application of intelligent gels in the medical science is one of the most actively researched areas according to Dr. Wu. At the University of Trondheim in Norway, researchers are working on an intelligent gel that expands upon the application of an electric field. Insulin is encapsulated in such a gel, and implanted into diabetic patients. Then controlled release is achieved by applying an electric field external to the body; needle-pricks are thus spared.

Elsewhere, scientists are developing a gel which shrinks in acidic conditions and expands in alkaline conditions. A gel which contains medication can therefore safely pass through the "acidic" stomach, and expand to release the drug as desired once it gets into the "alkaline" intestines.

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