

IIT-Hyderabad researchers develop device to detect bovine serum albumin

Human serum albumin (HSA) has been of great interest, and assessment of its level in human blood and urine is important in the diagnosis of a range of conditions such as malnutrition, kidney diseases and liver abnormalities.

Sangareddy: Indian Institute of Technology-Hyderabad (IIT-H) researchers are developing a simple, affordable and environmentally-friendly device that can detect biomolecule such as bovine serum albumin.

Human serum albumin (HSA) has been of great interest, and assessment of its level in human blood and urine is important in the diagnosis of a range of conditions such as malnutrition, kidney diseases and liver abnormalities. However, due to the structural similarities of bovine serum albumin (BSA) with respect to HSA, BSA has been used as a model protein in the research fields.

The published paper has been co-authored by Dr Suryanarayana Jammalamadaka, Associate Professor, Department of Physics, IIT-H, and his research scholar Dwipak Prasad Sahu. The development and performance of their sensor for the protein, bovine serum albumin, has been published recently in the reputed peer-reviewed journal Scientific Reports. Indeed, this work was also filed for a patent.

Speaking about the research and its applications, Dr Suryanarayana, “Several methods are used to assess the concentration of bovine serum albumin, such as spectroscopy, immunoassays and chromatography. But these methods require special testing equipment, which in turn requires skilled operators and delayed diagnosis. A sensitive, rapid and inexpensive method for the quantitative analysis of bovine serum albumin will make diagnostics faster and cheaper, this motivated the scientists from IIT-H to develop the reported sensor.”

Dr Suryanarayana further said, “We have developed a memristor to detect bovine serum albumin. The memristor or Resistive Random Access Memory (RRAM) is a device that can change its resistance state by changing the voltage. The switching from high resistance state to low resistance state with voltage is called SET switching and the reverse is RESET switching.”

The memristor essentially consists of two-terminals and the active material that is sensitive to the protein is sandwiched between two metal electrodes that are connected to the terminals. The IIT-H team used titanium dioxide (TiO₂), a white powder that is commonly used in cosmetics and sunscreens, as the active material. Silver was used as top electrode and fluorine doped tin oxide (FTO) was used as bottom electrode. When the active material (TiO₂) came into contact with bovine serum albumin, there was a lowering of voltage pertinent to SET switching.

The researchers went a step further to improve the sensitivity of their active material. They coated a layer of graphene oxide (GO) on the titanium dioxide (TiO₂). Graphene oxide contains oxygen-containing functional groups on its surface, which enhances the conductivity properties, thereby increasing sensitivity of the device to detect bovine serum albumin. Bovine Serum albumin levels as low as 4 mg in one mL of the test samples were detected by this hybrid device (TiO₂+GO).

“We have also tested our device for its durability and found that the device performed reliably continuously 650 times, added Dr Suryanaayana. Perhaps the most compelling case for the bovine serum albumin sensor developed by the IIT-H team is that all materials used in fabricating the sensor are environmentally friendly, cheap and biocompatible.

“We have provided proof of concept at this stage and extensive work is being carried out to make a portable device to detect Bovine Serum Albumin,” said the IIT-H faculty.

Source: Telangana Today

Date: 16/12/2019