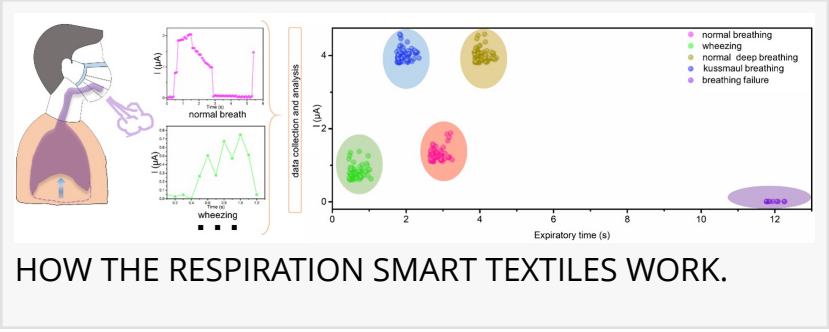
Hierarchical carbon nanotube-decorated polyacrylonitrile smart textiles for wearable biomonitoring



HOW THE RESPIRATION SMART TEXTILES WORK.

GA, UNITED STATES, September 25, 2024 /EINPresswire.com/ -- Independent of the temperature and humidity carried by the airflow, portable respiratory sensors are capable of continuously detecting respiratory intensity and frequency. Respiratory monitoring assesses physiological status and potential disease, preventing the escalation of adverse health conditions through early detection of recurrent wheezing, sleep apnoea and diabetes-induced kussmaul breathing.

Recurrent wheezing is a serious morbidity, and it is estimated that about one-third of school-age children exhibit this symptom in the first five years of life. Recurrent wheezing in childhood is a significant risk factor for irreversible lung damage in adulthood. Therefore, it is crucial to accurately identify children with this condition at an early age and to enhance the efficacy of treatment and prevention strategies. However, the capacity to diagnose these cases in the preschool period remains constrained.

In a study published in the KeAi journal Wearable Electronics, a group of researchers from China outlined their development of a sensor for continuous and stable monitoring of respiration. Notably, the sensor is isolated from the effects of temperature and humidity of the respiratory airflow and is able to accurately discriminate between wheezing and normal respiration.

"Breath-carrying temperature and humidity co-exist and interfere with each other, so detecting breath temperature or humidity to characterise breath inevitably reduces accuracy and stability," explains the study's senior and co-corresponding author, Yuanjie Su, a professor at the University of Electronic Science and Technology of China. "Typical respiratory sensors are enabled by assessing the expansion and contraction of the abdomen and chest during breathing, and they are immune to humidity and temperature. However, body movements such as limb movements or coughing can easily create crosstalk signals that can affect the accuracy of the readings. "

The team discovered that the integration of highly conductive, low-density carbon nanotubes into electrospun polyacrylonitrile scaffolds facilitated the detection of exhaled gas streams. Furthermore, the hydrophobic and flexible latex film encapsulation effectively prevents humidity and temperature fluctuations induced by exhaled gas, while having minimal impact on the mechanical deformation of exhaled gas.

“Moreover, the collection and analysis of multiple breath samples can accurately identify potential diseases, given the inherent variability and uncertainty associated with each individual breath, which is the ultimate goal of the monitoring process.,” adds Su.

According to Junlong Huang, the investigator who led the study, believes this is a major breakthrough for respiratory sensors. "Until now, respiratory sensors have been limited to temperature/humidity effects or limb movement effects. Our new preparation method represents a significant advancement in this field."

The team hopes that their findings will motivate others in the field to pursue further research and development to enhance the sensitivity of this type of respiratory sensor, thereby improving its practical applications.

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