

Abstract

Metabolic Rate Monitoring Using Quartz Tuning Fork Based Sensors †

Saurabh Parmar *, Bishakha Ray, Suwarna Datar

Department of Applied Physics, Defence Institute of Advanced Technology (DIAT), Deemed University, Girinagar, Pune 411021, Maharashtra, India

* Correspondence: saby1611@gmail.com

† Presented at the 8th International Symposium on Sensor Science, 17–26 May 2021; Available online: <https://i3s2021dresden.sciforum.net/>.

Published: date

Abstract: Human body produces volatile organic compounds (VOCs) due to various biological processes. Recent research indicates that these VOCs can be utilized to monitor the health of an individual's body. Metabolism is such a biochemical process that varies according to the lifestyle of a person. Researchers have found that metabolic rate can be recorded by detecting the amount of acetone release in an individual's breath. In this work, we demonstrate the use of a polymer modified quartz tuning fork (QTF) based sensor to detect various levels of acetone (5–400ppm). As per reports, different levels of acetone expelled in breath can correspond to presence of distinct diseases in a human being. Initially, we tested free standing polymer films for change in elastic modulus (E_m) using Atomic Force Spectroscopy. Since the combination of polystyrene and cellulose acetate (PS+CA) showed good change in E_m , this material was selected to modify the QTF-based sensors. The sensor was able to detect various concentrations of acetone with high accuracy. After testing, various machine learning algorithm were utilized to better improve classification.

Keywords: biomarkers; quartz tuning fork; machine learning; metabolism; force spectroscopy