**Mask assistance to colorimetric sniffers for detection of COVID-19 diseases using exhaled breath metabolites**

*Mohammad Mahdi Bordbar1, Hosein Samadinia1, Ali Hajian 2, Azarmidokht Sheini3, Elham Safaei4, Jasem Aboonajmi4, Fabiana Arduini5, Hashem Sharghi4, Pegah Hashemi6, Hosein Khoshsafar1, Mostafa Ghanei1, Hasan Bagheri1,\**

*1 Chemical Injuries Research Center, Systems Biology and Poisonings Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran*

*2* *Institute of Sensor and Actuator Systems, TU Wien, Gusshausstrasse 27-29, 1040, Vienna, Austria*

*3Department of Mechanical Engineering, Shohadaye Hoveizeh Campus of Technology, Shahid Chamran University of Ahvaz, Dashte Azadegan, Khuzestan, Iran*

*4 Department of Chemistry, College of Sciences, Shiraz University, Shiraz, Iran*

5 *Department of Chemical Science and Technologies, University of Rome Tor Vergata, Via della Ricerca Scientifica, 00133, Rome, Italy.*

6 *Research and Development Department, Farin Behbood Tashkhis LTD, Tehran, Iran*

Corresponding author: [h.bagheri@bmsu.ac.ir](mailto:h.bagheri@bmsu.ac.ir)

According to World Health Organization reports, large numbers of people around the globe have been infected or died for COVID-19 due to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. Researchers are still trying to find a rapid and accurate diagnostic method for revealing infected people by low viral load with the overriding goal of effective diagnostic management [2]. Monitoring the body metabolic changes is known as an effective and inexpensive approach for the evaluation of the infected people [3]. Here, an optical sniffer is introduced to detect exhaled breath metabolites of patients with COVID-19 (60 samples), healthy humans (55 samples), and cured people (15 samples), providing a unique color pattern for differentiation between the studied samples. The sniffer device is installed on a thin face mask, and directly exposed to the exhaled breath stream. The interactions occurring between the volatile compounds and sensing components such as porphyrazines, modified organic dyes, porphyrins, inorganic complexes, and gold nanoparticles allowing for the change of the color, thus being tracked as the sensor responses. The assay accuracy for the differentiation between patient, healthy and cured samples is calculated to be in the range of 78%‒84%. The changes in the color of the sensor have a linear correlation with the disease severity and viral load evaluated by rRT-PCR method. Interestingly, comorbidities such as kidney, lung, and diabetes diseases as well as being a smoker can be diagnosed by the proposed method. As a powerful detection device, the breath sniffer can replace the conventional rapid test kits for medical applications.

References:

[1] WHO, Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases, WHO - Interim Guid. 2019 (2020) 1–7.

[2] B. Shan, Y.Y. Broza, W. Li, Y. Wang, S. Wu, Z. Liu, J. Wang, S. Gui, L. Wang, Z. Zhang, W. Liu, S. Zhou, W. Jin, Q. Zhang, D. Hu, L. Lin, Q. Zhang, W. Li, J. Wang, H. Liu, Y. Pan, H. Haick, Multiplexed Nanomaterial-Based Sensor Array for Detection of COVID-19 in Exhaled Breath, ACS Nano. 14 (2020) 12125–12132. doi:10.1021/acsnano.0c05657.

[3] S. Grassin-Delyle, C. Roquencourt, P. Moine, G. Saffroy, S. Carn, N. Heming, J. Fleuriet, H. Salvator, E. Naline, L.J. Couderc, P. Devillier, E.A. Thévenot, D. Annane, Metabolomics of exhaled breath in critically ill COVID-19 patients: A pilot study, EBioMedicine. 63 (2021). doi:10.1016/j.ebiom.2020.103154.