

Your Exhaled Breath May Reveal Gastric Disorders

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When we exhale, we breath out several thousands of molecules with a diverse range of concentrations. However, when we have any disease or metabolic disorder, or any kind of bacterial infection, the profile and excretion kinetics of these exhaled molecular constituents change. Their concentrations may also change from the normal levels. Some of these molecules or their specific isotopes may be associated with the pathogenesis of the disease and can be markers of the particular medical conditions. Consequently, when our health changes, breath analysis may provide an alternative, rapid and non-invasive diagnostic method.

Dr. Manik Pradhan and his research group have recently developed a new-generation non-invasive diagnostic strategy by means of human breath analysis that might help physicians for early and quick diagnosis of *Helicobacter pylori* bacterial infection residing in human stomach as well as its related complicacies like ulcer disease and non-ulcerous dyspepsia, thus obviating the existing painful endoscopic and biopsy based tests.

Helicobacter pylori is a very common bacterial infection in human stomach and causes stomach inflammation (gastritis). This infection may lead to the development of peptic ulcer disease and certain types of cancer. Interestingly, this bacterial infection is often asymptomatic, indicating that most individuals have no noticeable signs or symptoms and thus their infection with the bacteria remain undiagnosed. Therefore, an early diagnosis is very essential to prevent complications.

Dr. Pradhan has established research collaborations with medical scientists to ensure the translation of the new breath analysis technology, so-called, “Pyro-Breath” to clinical testing. The medical challenges Dr. Pradhan’s team has tackled include finding new “Breath-Prints” and estimating “Risk-Factors” of various gastric disorders for non-invasive diagnosis of these diseases with an accuracy better than 96%



when compared with “gold-standard” endoscopic tests. This will make appealing case studies for communication of the impact of modern analytical science on health care to the general public and will certainly be a “game-changer” in non-invasive medical diagnosis. The “Pyro-Breath” technology exploits a simple residual gas analyzer (RGA) which scans specific “Breath-Print Masses (BPMs)” in real-time. These BPMs are strongly associated with the onset of *H. pylori* infection and various gastric disorders such as gastritis and ulcer. From the nature of the various exhaled molecules or their isotopic species (breath-prints), it is possible to noninvasively monitor whether a person has a specific type of gastric disorder or *H. pylori* bacterial infection or both. As this is a non-invasive and painless method, it would be an attractive and alternative diagnostics method for any persons including infants, children, pregnant woman and seniors. This breath test method may also help to follow-up the patients after standard therapies, thus avoiding further painful and invasive endoscopic method.

The idea of disease diagnosis based on human breath analysis was also presented to Dr. Harsh Vardhan, the Hon’ble Union Minister of Science and Technology, Govt. of India, when Dr. Vardhan visited Dr. Pradhan’s lab at S. N. Bose Centre, Kolkata in 2015. Dr. Vardhan’s great appreciation on breath analysis work and subsequent tweet played a pivotal role in Dr. Pradhan’s group in transforming ideas into a product. The group has already filed a patent, dated on 21/01/2016 (File No: 201631002214) for this technological innovation.



However, few prototype “Pyro-Breath” analyzers have been developed in the last few years to establish the *proof-of-concepts* and subsequently for demonstration and technology showcase as picturised below. One prototype breath analyzer has currently been installed in a reputed hospital at Salt Lake, Kolkata for large-scale clinical trial. Breath tests are being performed on patients in regular basis for non-invasive diagnosis of *H. pylori* bacterial infection as well as gastric disorders. Three startup companies have already shown their interests to take up this technology for commercialization and the transfer of technology (TOT) is currently under process through NRDC, New Delhi.

Related Publications and Patent:

1. *“Residual gas analyzer-mass spectrometry for human breath analysis: a new tool for the non-invasive diagnosis of Helicobacter pylori infection”*: A. Maity, G. Banik, C. Ghosh, S. Som, S. Chaudhuri, S. Daschakraborty, S. Ghosh, B. Ghosh, A. K. Raychaudhuri and M. Pradhan; ***Journal of Breath Research***, 8, 016005 (2014)

2. *“Molecular hydrogen in human breath: a new strategy for selectively diagnosing peptic ulcer disease, non-ulcerous dyspepsia and Helicobacter pylori infection”*: A. Maity, M. Pal, S. Maithani, B. Ghosh, S. Chaudhuri and M. Pradhan; ***Journal of Breath Research***, 10, 036007 (2016)

3. Patent filed: *“A System and Kit For Non-invasive detection of Peptic Ulcer Diseases, Non-Ulcerous Dyspepsis And Helicobacter Pylori Infection”*, **Indian Patent: File No: 201631002214 (dated: 21/01/2016)**; Inventors: Manik Pradhan & Abhijit Maity