

Gas Analysis | HPR-20 TMS
Application Note AN-10018.2

Real Time Human Breath Analysis

Breath by Breath Analysis of Expired Isoprene during Exercise



The Hidden HPR-20 Transient MS

Isoprene in Human Breath

The use of isoprene as a marker in human breath for blood cholesterol has been suggested by a number of researchers. It is theorised that the use of breath isoprene as a non-invasive technique could be effective as a diagnostic tool to assess changes in blood cholesterol levels in individuals.

During exercise, isoprene is washed from the muscles and exhaled. The mechanism for this is thought to be via the pulmonary gas exchange process. This is apparent with an initial rise in expired concentration, followed by a decrease and stabilisation. The HPR-20 Transient MS was ideal for this application due to the fast response, wide dynamic range and high sensitivity offered by the PIC detector. A proprietary breathing mask was modified to accept a heated Quartz Inlet Capillary (QIC).

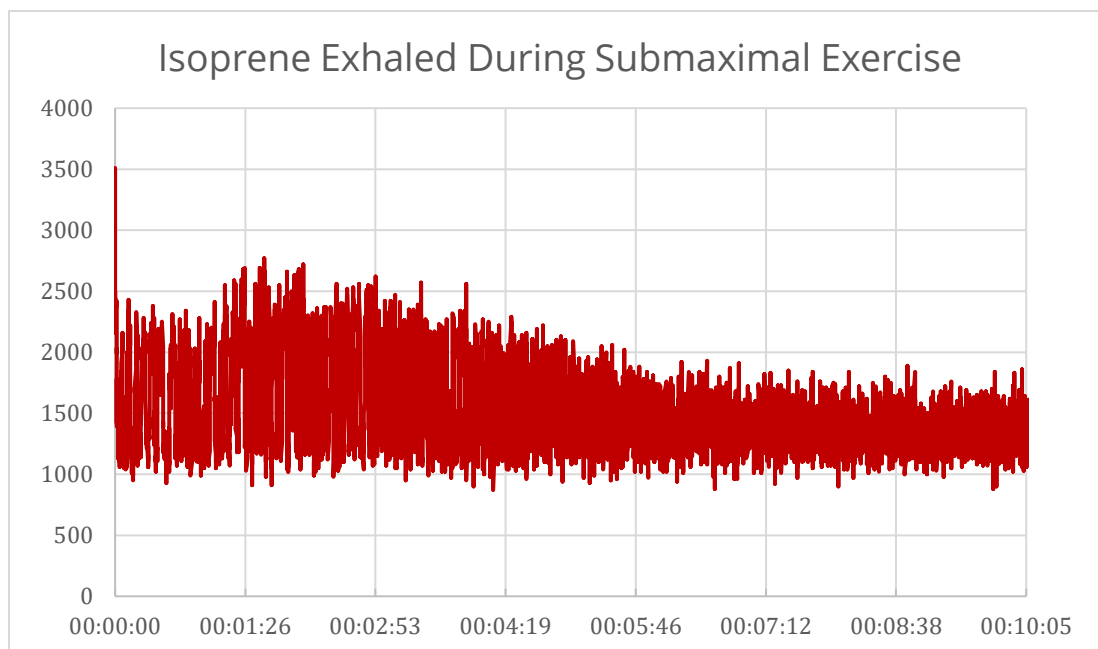


Figure 1: Trend data showing the change in isoprene concentration in expired breath during a submaximal exercise test.

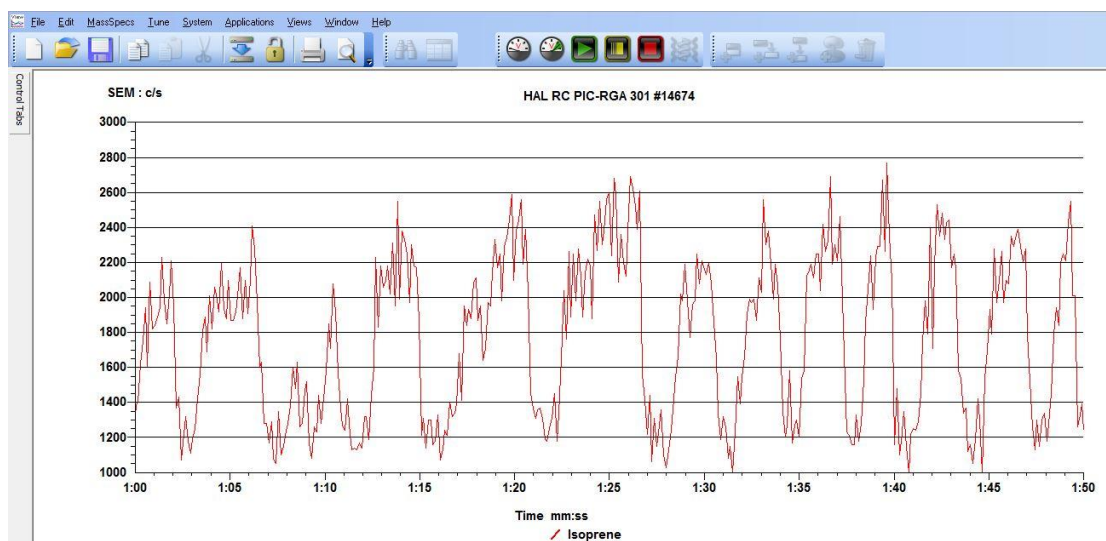


Figure 2: MASSoft Professional Data showing breath by breath isoprene levels during an exercise test.

Results

Subjects of varying ages and fitness levels were set a submaximal exercise regimen on a stationary bicycle. Resistance was controlled by the subject and rate of perceived exertion was used to control the effort level. The test consisted of 1 minute rest, then 5 minutes of gentle exercise, followed by another rest period of 5 minutes.

The initial level of isoprene can be seen, ~50 ppbv. The initial 'washing out' of the isoprene from the muscles to the blood stream is evident in figure 1, approximately 200 ppbv. This is then followed by a decrease, to a baseline level lower than the initial level, suggesting that the blood isoprene level did not return to the initial

level during the rest period. This returned to the starting level after an hour of rest.

Figure 2 shows the fast response of the HPR-20 TMS Transient MS allowing for each breath to be viewed. From this end tidal as well as breathing rate can be readily deduced. This is in contrast to offline measurements that do not offer this level of detail.

Conclusions

- Real-time analysis of exhaled isoprene is proven to be viable.
- The Hiden HPR-20 TMS is proven to be the ideal product for high speed, high sensitivity analysis of compounds in human breath.