Chemical Barcodes for Real-Time Sweat pH Monitoring Based on Wearable Micro-fluidic Platforms Incorporating Ionic Liquids

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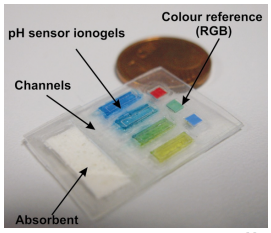
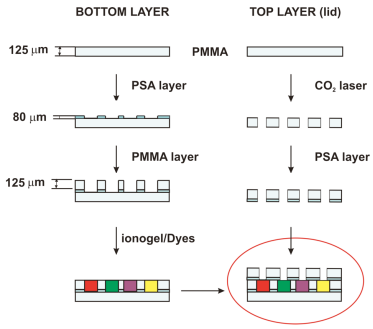
Sweat is naturally generated during exercise, and real-time monitoring of its composition provides very rich information about the physiological condition of the individual.[1] There are several factors that correlate sweat pH and health, however, relatively little is known about them due to the difficulties in performing realtime on-body measurements during exercise.

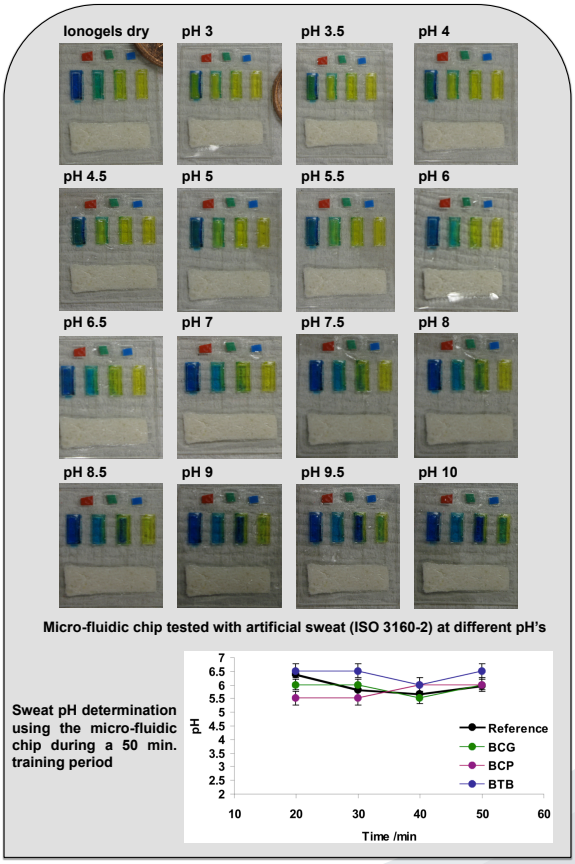
Whole body sweat collection technics[2]



	pH	
1- BROMOPHENOL BLUE	3.0	4.6
2- BROMOCRESOL GREEN	3.8	5.4
3- BROMOCRESOL PURPLE	5.2	6.8
4- BROMOTHYMOL BLUE	6.0	7.6



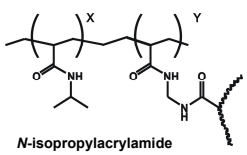
Barcode fabrication process



Micro-fluidic chip tested with artificial sweat (ISO 3160-2) at different pH's

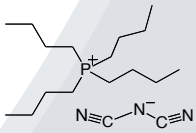
Sweat pH determination using the micro-fluidic chip during a 50 min. training period

The autonomous, wearable and flexible micro-fluidic device based on ionogels[3], ionic liquid polymer gels, is used to monitor the pH of sweat generated during exercise. The $[P_{4,4,4,4}]^+[dca]^-$ ionic liquid (IL) is employed to synthetise the poly(*N*-isopropyl-acrylamide) ionogel by UV-photopolymerization.



N-isopropylacrylamide

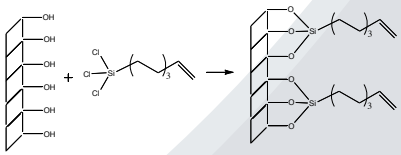
N,N'-methylene-bis(acrylamide)



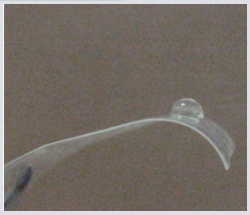
Tetrabutyl-phosphonium dicyanamide

$[P_{4,4,4,4}]^+$ $[dca]^-$

Surface Oxidation by O_2 plasma



Silanisation with 7- octenyltrichlorosylane [4]



CONCLUSIONS

In this work, the fabrication, characterization and the performance of a micro-fluidic system based on ionogels for monitoring in real time mode the pH of the sweat generated during an exercise period has been presented. The ionogel-dye interactions ensure no leaching of the dyes during experiments, providing long durability of the device. The approach presented here can provide immediate feedback regarding sweat composition, pH, to individuals during exercise period.

REFERENCES

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[2] Shirreffs S M , Maughan R J J Appl Physiol 1997;82:336-341

[3] F. Benito-Lopez, R. Byrne, A. M. Raduta, N. E. Vrana, G. McGuinness, D. Diamond, Lab Chip 2010, 10, 195-201.

[4] S. Samanta, J. Locklin, Langmuir 2008, 24, 9558-9565

ACKNOWLEDGMENT

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