BREATH ALCOHOL SENSOR FOR EMERGENCY CARE

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Background. Breath alcohol sensors according to the state of the art require forced and prolonged expiration from the person to be tested. Therefore, they cannot be used on persons who are either non-cooperative or impaired. Approximately every fifth patient arriving at an emergency care unit is influenced by alcohol, and it is important to assess the cause of confused behavior or decreased consciousness. Furthermore, alcohol sensors based on electrochemical or semiconductor elements have limited selectivity. The response to acetone is of specific interest due to its high prevalence among diabetics. We are developing a new sensor based on non-dispersive infrared (NDIR) spectroscopy, with the aim of solving these and related problems. In this paper we focus on the selectivity properties related to the clinical application.

Results. Figure 1 shows the absorption bands of ethyl alcohol and acetone in the range 3-10 µm obtained with data from a public data base.[1] For clinical breath analysis, a large number of endogenic and exogenic substances are of interest, including acetone, ammonia, methane, and sulphuric compounds. In our system carbon dioxide is used as tracer substance which is always present at relatively predictable concentrations.[2, 3] For this study, we have performed simulations of IR signal transmission through various interference filters, using publicly disclosed IR spectra of all the aforementioned substances. The results indicate that the combination of the alcohol absorptions at 3.4 and 9.5 µm enables highly selective performance. The simulation results have been confirmed by experiments.

Industrial applications. The reported results are directed towards the development of an alcometer for use in emergency care. The project is receiving financial support from Vinnova.

References.

[1]Pacific Northwest National Laboratory (PNNL) https://secure2.pnl.gov/nsd/nsd.nsf/Welcome.
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[3]B Hök, H. Pettersson, A. Kaisdotter-Andersson, S. Haasl, P. Åkerlund, IEEE Sensors J. 10, (2010) 10-15.

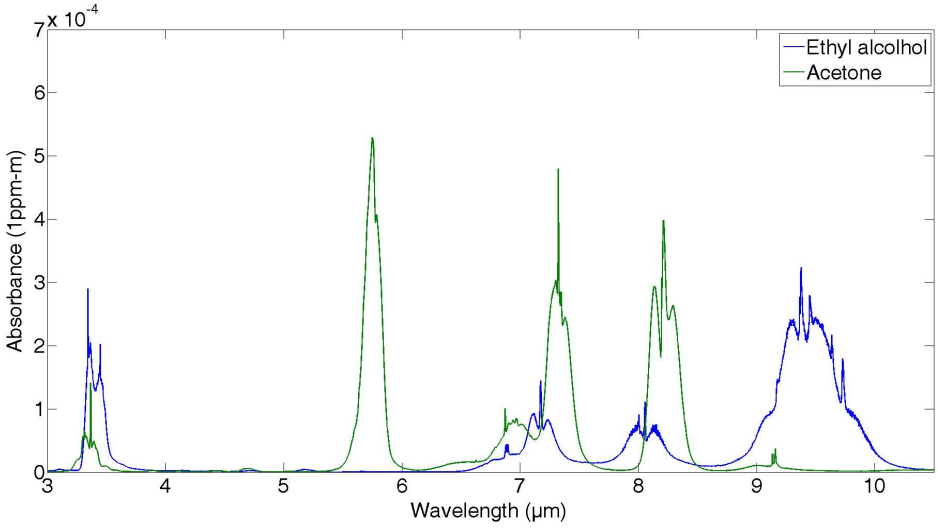

Figure 1. Absorption spectra of ethyl alcohol and acetone.[1]