ENHANCING RAMAN DIFFRACTION TO MEASURE KETONE BODIES IN HUMAN BREATH.

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Introduction; Diabetes is a growing problem; in under 18 years, 9% of the world population will have diabetes. Currently, despite technological advances across the healthcare sector, diabetes patients still need to take regular blood samples to monitor their glucose levels. This practice is painful; bothersome; and may induce infections. These factors cause that many patients stop monitoring their glucose, leading to the same levels in the blood reach critical values. An alternative method, is based on the measuring of fingerprints of substances in the breath[1]. This development is focused on detecting ketone bodies in human breath, those substances are produced by a condition called diabetic ketoacidosis. This condition is characteristic of Type I diabetes, where, in patients in critical situations of acute impairment of insulin in the blood, even present up to 5 ppm of ketone bodies in breath. To measure a so small concentration, as previously mentioned, Raman gas spectroscopy is an excellent tool, specially employing the Surface Enhanced Raman Spectroscopy (SERS)[2,3].
In this paper, we show preliminary results on enhancing the Raman diffraction produced by ketone, employing silver nano particles deposited on a polystyrene surface.

Experimental; Using a Raman spectrometer Horiba, model 632, with a laser of 632.8 nm, a number of spectra of an air - 0.035% ketone mixture were obtained. Those spectra were achieved thanks to an enhancing Raman diffraction technique developed in our laboratory. We have used a polystyrene surface as a subtract, where we have deposited silver nano particles. To deposited those particles, first we have dispersed them in isopropyl alcohol and then we have spread the slur on a polystyrene substrate. Subsequently, the substrate was dried, in a woven at 105C. Afterwards, it was placed on the stage of the Raman spectrometer. Then, we have sprayed a flow of air containing 0.035% acetone on the subtract surface.
In a first stage, the mixture of air and acetone was sprayed for 30 seconds on the subtract, and subsequently the spraying was stopped and a first a Raman spectrum was obtained. Subsequently, we have performed a Raman spectrum each 30 seconds after the first step, in order to evaluate the ketone desorption from the polystyrene subtract.

Results; First of all, it is important to indicate that without the presence of silver nano particles on the subtract no ketone picks appears in the Raman spectra. Figure 1 shows the spectra obtained with the presence of silver nano particles in this experiment. We observe that very distinct ketone peaks appears. The spectra in red corresponds to the first stage, where the mixture was freshly sprayed. A large peak appears at 675 cm-1, and two smaller peaks at 610 and 655 cm-1. The green, magenta and blue corresponds to desorption of ketones in the polystyrene surface.

Conclusion; The results shown that this technique permits to employ in a very practical way the Raman method to detect and measure ketone bodies in a air mixture. Therefore, it is a very promising technique to measure Ketone bodies in the human breath.

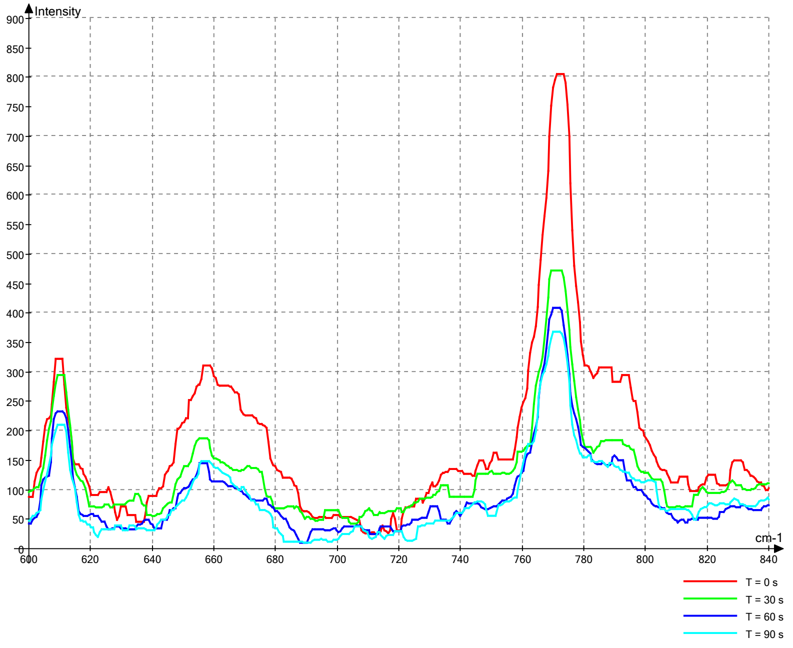

Figure 1. Raman spectra obtained a different times of the experiment.

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