CO_2 Sensor for Food Application

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The carbon dioxide levels inside meat packages can be used as indicator of freshness. If the CO2 concentration changes during storage it is a clear indicator that bacteria are growing inside the container and / or the package is not well sealed and the modified atmosphere has been compromised. However, a non-destructive method for determining the CO2 concentration within the package has not, as yet, been reported.

To this end, the objective of the SmartPack project is to exploit the development and integration of a CO2 sensor in meat packages using the imaging and communications capabilities of Smartphones for freshness detection. Optical CO2 sensors based on the acidity of this molecule, are normally solvent-based sensors, the drawback of this approach in the food packaging industry is due to the long-term instability of the sensors, arising from the quaternary ammonium hydroxides decomposition. However, in this project we avoid the use of these compounds. Water based sensors are prepared using meta cresol purple sodium salt as indicator, glycerol as plasticizer and sodium bicarbonate as buffer in a matrix of hydroxyethyl cellulose. In this way, the lifetime is increased and also this composition creates an easily printable ink. Moreover, ionic liquids have been included in the matrix making the sensor more selective to CO2 than other gases due to its higher solubility.

This new water-based sensor has been characterised in terms of carbon dioxide sensitivity, dynamic response, and stability under different conditions. The sensor responds up to 100% of carbon dioxide. In Figure 1 can be observed the change in colour from 0 to 100% of CO2. Moreover, it has been demonstrated that the stability is much higher than the solvent-based sensors making them suitable for smart packaging application. The sensitive ink has been optimised and characterized using bench-top instrumentation. Moreover, the RGB and HSV readout of standard digital photographic cameras have been used as a simple imaging technique

The next steps include testing of the printed sensors integrated in meat packages using a mobile phone application as a detector to progress the study towards the intended application as a smart packaging tool.

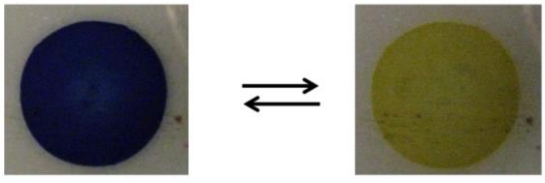

Figure 1. Water based CO2 sensor colour variation at 100% Nitrogen and 100% CO2 atmospheres.

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