OdourScan Application Note 3: Detection of Hexanal in Macadamia Nuts

Introduction:

This study was undertaken to assess whether an electronic nose, e.g., OdourScan Model 2000, could be used to detect the presence of Hexanal in Macadamia nuts. Hexanal is recognised as a breakdown product during the autoxidation of oils. As such it is an indicator of the stability and shelf life of nuts and other oil carrying seeds.

Description:

The OdourScan Model 2000 Electronic Nose consists of six gas sensors that are chosen to sense different chemical species in gases or vapours. A sample of the headspace in a jar containing the sample of nuts was collected and injected into the OdourScan's sensor. The response from each sensor is used to predict the concentration of hexanal based on a prior calibration curve.

To establish which of the six gas sensors or combinations provided a linear response to hexanal concentration, four standards of hexanal in water were prepared. Table 1 show the outputs from each sensor versus the concentration of hexanal. Figures 1 through 4 show the plots form the OdourScan sensors for each level of hexanal. Figure 5, shows the plot of the response from sensor 1 vs the hexanal concentration. This procedure established that sensor 1 gave the best sensitivity and linearity.

SampleID	Channel1	Channel2	Channel3	Channel4	Channel5	Channel6	Ref ug/ml
Hexanal1ug/ml	156	18	136	250	109	29	1
Hexanal2ug/ml	202	31	93	73	69	34	2
Hexanal4ug/ml	230	75	195	241	106	96	4
Hexanal8ug/ml	238	39	250	557	162	29	8

Table 1. OdourScan response for Hexanal.

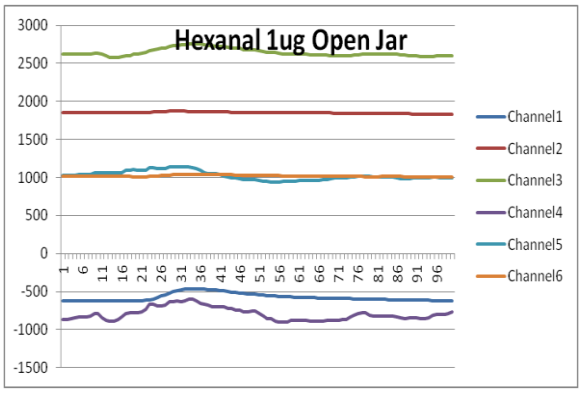


Figure 1. OdourScan response for 1ug/ml Hexanal

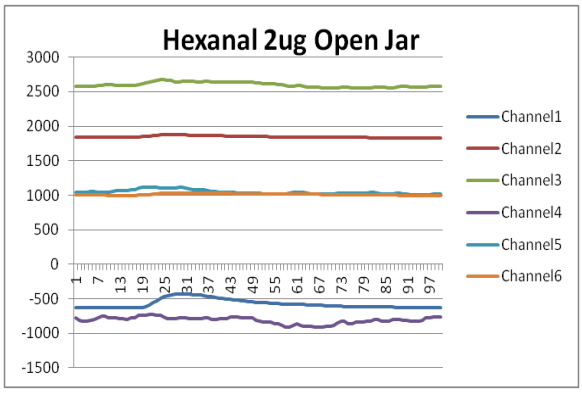


Figure 2. OdourScan response for 2ug/ml Hexanal

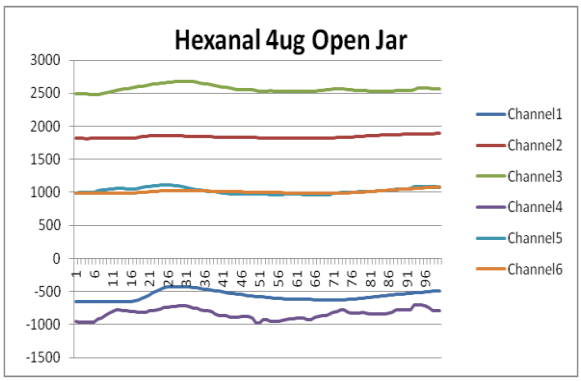


Figure 3. OdourScan response for 4ug/ml Hexanal

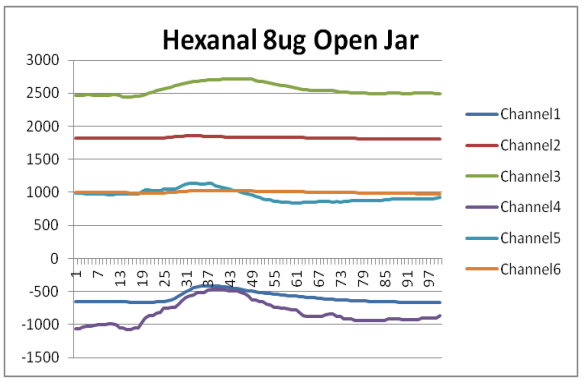


Figure 4. OdourScan response for 8ug/ml Hexanal

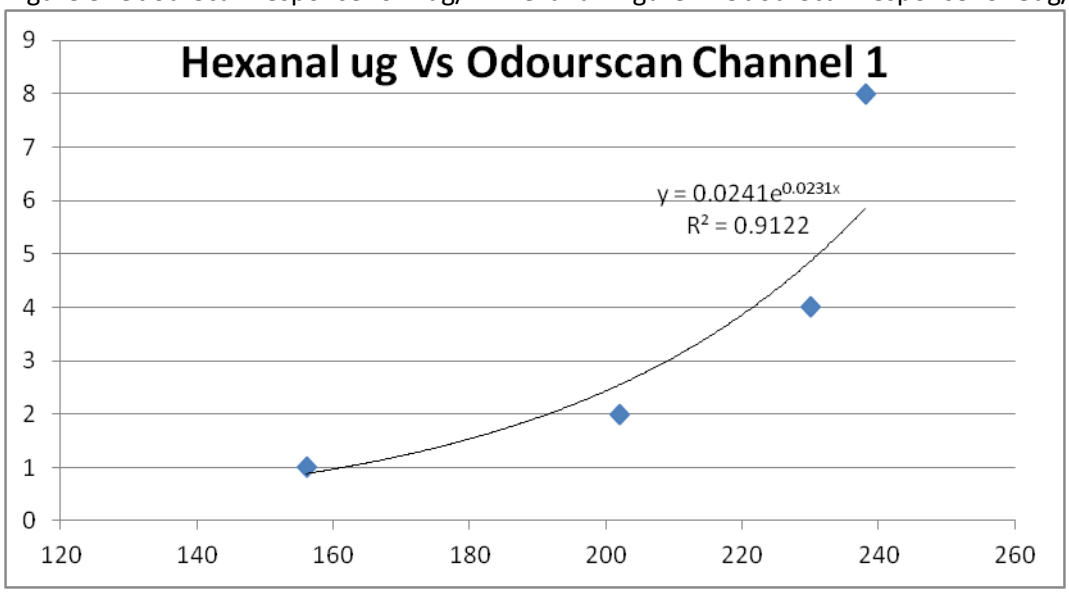


Figure 5. Plot of Sensors responses to Hexanal

Since the hexanal is in oil, a calibration curve was set up using four samples of hexanal in canola oil. Figure 6 shows the response from sensor 1 for hexanal in canola oil. A linear regression plot provides a calibration equation that can be used to measure hexanal in oil.

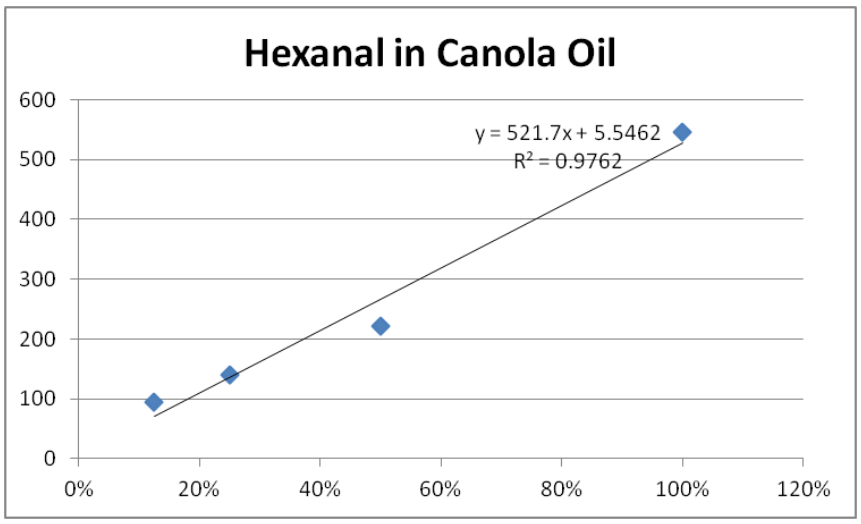
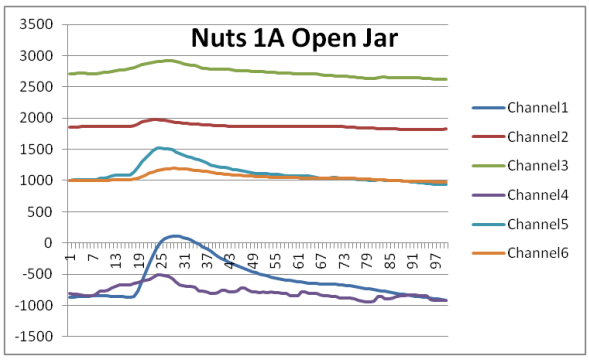


Figure 6. Plot of Hexanal in Canola Oil using Sensor 1.

Six samples of macadamia nuts that had been picked at 2 week intervals and therefore exhibited different periods to undergo autoxidation were analysed using OdourScan and the above calibration curve.

Results:

Figures 7 through 12 show the plots of the response from the OdourScan for each sample.



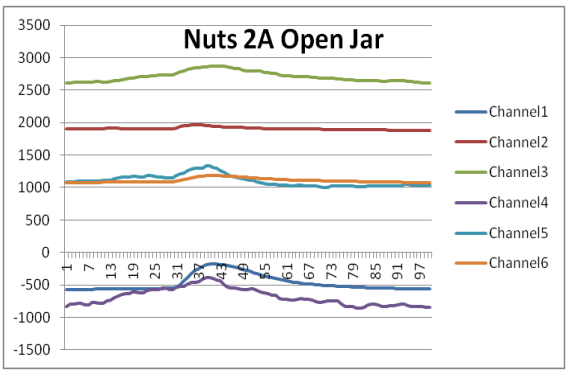
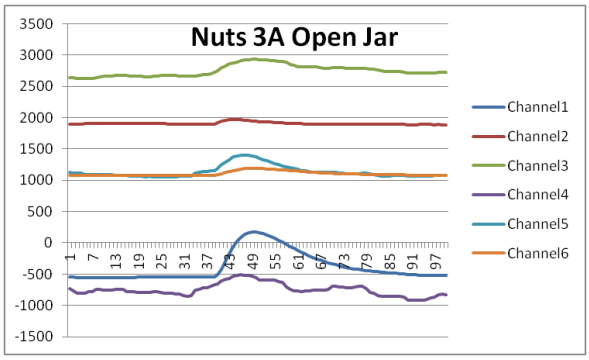


Figure 7 and 8 . OdourScan plots for Samples 1 and 2



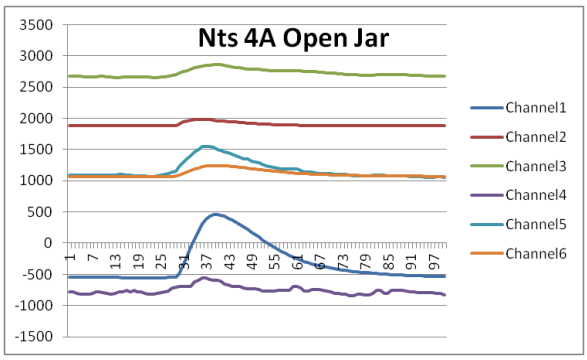
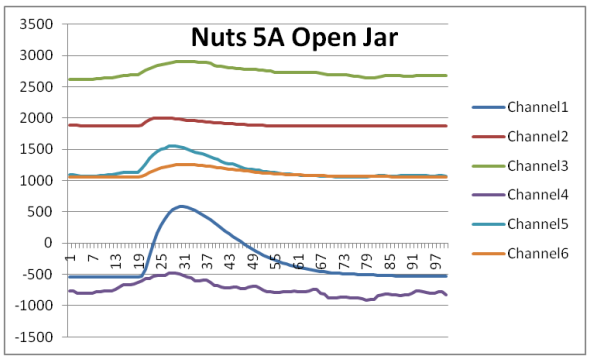


Figure 9 and 10. OdourScan plots for Samples 3 and 4



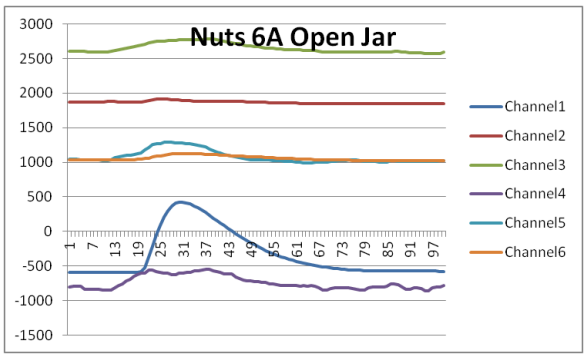


Figure 11 and 12. OdourScan plots for Samples 5 and 6

Table 2 provides the results of the analysis for the six samples.

SampleID	Channel1	Channel2	Channel3	Channel4	Channel5	Channel6		Hexanal cc
Maca1A	970	115	202	320	510	191		57
Maca2A	389	54	251	413	239	108		16
Maca3A	722	65	298	272	300	109		40
Maca4A	994	99	191	238	454	174		59
Maca5A	1128	121	285	314	472	202		68
Maca6A	1017	39	181	273	251	91		60

Discussion:

The OdourScan Model 2000 is shown in the study to be very sensitive to detecting Hexanal, ie, less than 8ug/ml. The prediction of hexanal concentration in the headspace of a sample of nuts has been demonstrated however the level of detection was not established. GC analysis of the headspace would allow a means of verifying the OdourScan's response.

The OdourScan Model 2000 Electronic Nose offers a very rapid mechanism of measuring hexanal and possibly as a means of predicting shelf life.

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