

# The sensor for food freshness

## 食物新鲜度传感器

Various estimates of the amount of food wasted in the world vary between 33% and 50%. A comprehensive survey of the issue can be found here:

全球的各种食物浪费量预计在33%到50%之间。针对这一问题的一项综合调查可以参考以下内容：

[https://en.wikipedia.org/wiki/Food\\_waste](https://en.wikipedia.org/wiki/Food_waste)

It would be advantageous in certain situations to employ a chemical sensor which could give a warning of imminent spoilage in foodstuffs of various kinds, for example in storage (in bulk or in domestic refrigerators) by means of fixed monitors, or in market food displays by means of a portable, hand-held screening device.

在某些情况下，如果可以采用一种化学传感器针对即将过期的食物进行报警，对于解决食物浪费问题将会非常有利，比如大量储存的环境或者冰箱，安装监测器，或者对于市场食品展示，通过便携的手持检测仪进行检测。

The basic fuel cell electrochemical sensor such as is used in breathalysers is sensitive to substances other than alcohol. This “cross-sensitivity” is of no consequence in breath alcohol measurement but it can provide the basis for early detection of the emission of decay products in food. Tests we have carried out have shown the following possible areas of application:

基本的燃料电池传感器比如应用在呼气酒检测仪中的，对于酒精之外的一些物质也会有响应。这种交叉灵敏度在酒精检测中是无关紧要的，但是它可以提供食物即将腐烂的检测的依据。我们的实验证明可以用于以下可能的领域：

- Fruit and vegetables, arising from fermentation of sugars to form ethanol 水果蔬菜，糖类发酵产生乙醇
- Milk and milk products, identities uncertain 牛奶和牛奶制品，特性不确定
- Meat, probably due to release of primary amines 肉类，或许由于伯胺的释放
- Fish, probably due to release of secondary amines. 鱼，或许由于仲胺的释放

The sensor can be configured as a continuous analyser, but in many cases an intermittent pumped sample may be more appropriate. A high gain dual rail current to voltage amplifier (a pcb is available for development on our web site) is required, such as the formaldehyde sensor circuit here:

传感器可以作为连续分析仪进行配置，但是在很多情况下，间歇泵吸式采样可能会更合适。我们提供高增益双电源电流电压放大电路板作为研发参考，类似甲醛传感器电路，见下

<https://dart-sensors.com/wp/wp-content/uploads/2014/10/HCHOSensorDatasheet.pdf>

and additionally a small electric pump when a discrete periodic sample is required: 另外有小型的才氧气泵，见下：

<https://www.dartsensors-sz.com/showpro.asp?id=70>

The indication is not 100% reliable, there will be false positives or negatives depending on how it is set up. Some foodstuffs (watery, such as cucumber and celery, and leafy) give no detectable gases. Application to potato storage has so far proved problematic. Some fruits (such as banana) give copious vapours of ethylene while still ripening. Application to storage of single foodstuffs is probably less demanding, but if monitoring a broad range of foods it is probably best to grade the signals into colour bands such as:

不是百分百可靠，会因设置不同产生正向或反向错误。一些食物（水分比较多的，例如黄瓜，芹菜，叶菜类）不释放可检测的气体。对于土豆储存目前还不确定。一些水果（比如香蕉）在成熟的过程中释放大量乙烯气体。应用于单一食物的需求或许很少，但是如果监测范围较广的食物种类，或许最好的方发是给与各种信号以色带显示，如下：

<b>GREEN – Fresh food</b>	<b>YELLOW – Ripening/ maturing food</b>	<b>RED – rotting food</b>
BASELINE	260* Two apricots	288 Rotting small tip of red pepper 302
EMPTY JAR	263 Yellow banana	893 Stale cut lemon 1023 in 1 minute
Orange	263 Grated hard cheese	409 Bad end of onion 1023 in 2 minutes
Apple	264 Soft carrot	454 Bad slice of peach 1010
Grapefruit	263 Soft peach 1023 in 9 mins.	Fish after two days 1023 in 1 minute
Milk	254 Soft avocado	417 Beef mince 5 days (mould forming) 1023 in 2 minutes
Potato	254 Beef mince 3 days	441 Two bad peaches 804
Goat cheese 3 days before use date	258 Milk 2 days	312 Avocado two days 1023 in 3 minutes