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參展科別 化學科

作品名稱 **ORGANIC AND NON ORGANIC CEREALS The experimental pattern that marks the difference**

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ABSTRACT OF EXHIBIT
TAIWAN INTERNATIONAL SCIENCE FAIR

1. Purpose of the research

The purpose of this research is to make a suitable experimental pattern to distinguish, by scientific method, organic cereals from non organic cereals. The reference ideas consider cereals (rice, barley and maize) as a complex system that possesses its own chemical–physical properties. These cereals are able to maintain traces of the cultivation process. In non organic cereal grains foreign molecules, from synthesis substances used during their cultivation and/or in their final processing, can be found. These kinds of molecules would be absent in organic cereals. The effect of these foreign molecules traces on the principal components (glucides, proteins, lipids) of cereals is investigated by Infrared Spectroscopy (IR).

2. Procedures

The spectra of a small quantity of cereal meal are recorded by the ATR (Attenuated Total Reflectance) sampling method. The meal is obtained from selected grains of rice and barley, that are grated near the germ. On the contrary, the maize grains, are cut lengthwise and the two halves are grated on the interior surface. This procedure of preparing samples, withdraws that part of the non organic cereal grains where foreign molecules are more abundant. The meal mass amounts to only a few milligrams; so in this way the dilution effect caused by starchy and proteinic parts onto the lipid part, is reduced. The cereal packaging has to be intact, well preserved and the expiry date has to be far–off.

The organic packaging has the European Certification symbol and that of the authorizing agency. The cereals used in this research, have been labelled with symbols. The experimental data are processed by the NMC (Nearest Means Classification: J.Chem. Educ. 2003, 80, 542) method, adapted to cereals.

3. Data

The NMC method is based on the individuation of suitable absorption bands of the IR spectrum and, for each of them, the calculation of the following quantities: the

average value of the wave number (<$\bar{\upsilon}$>); the (Σ<$\bar{\upsilon}$>) value; the |diff.|=|($\bar{\upsilon}$–<$\bar{\upsilon}$>)| value and the Σ|diff.| value.

At the end the sum of the Σ|diff.| for all selected bands is computed in order to obtain the $\Sigma(\Sigma|\text{diff.}|)$. Then a graph is plotted using (Σ<$\bar{\upsilon}$>) and $\Sigma(\Sigma|\text{diff.}|)$ variables. The graph has a gap between the organic cereals and the non organic ones; in other words the organic cereals are found in a particular area, whilst the non organic cereals are found in another area. The boundary between the two areas is a particular value of the $\Sigma(\Sigma|\text{diff.}|)$. This is the pattern that distinguishes organic cereals from non organic ones.

4. Conclusions

For some cereals, the gap is bigger than others; but in any case the position of the cereals on one side of the boundary line or on the other, is clear. An experimental scientific pattern that marks the difference between organic cereals and non organic ones, can be useful to organic farms, authorizing agencies and consumers. This research has planned a route to find such a pattern.

評語

IR investigation to the ingredients from cereals. By means of Nearest Means Classification, the data showed apparent difference between the organic Cereals and the non-organic, providing convenient approach to differentiate the cereal products.