Evaluation of food fraud detection using *front-face* fluorescence spectroscopy

June 16, 2022 Xavier Marín Final Degree Project

Objectives

- Evaluate *front-face* fluorescence spectroscopy (FFFS) as a method of analysis and control to detect fraud.
- Identify fluorophores present in fraudulent foods to detect with FFFS.
- Browse FFFS equipment on the market today.

Fluorescence

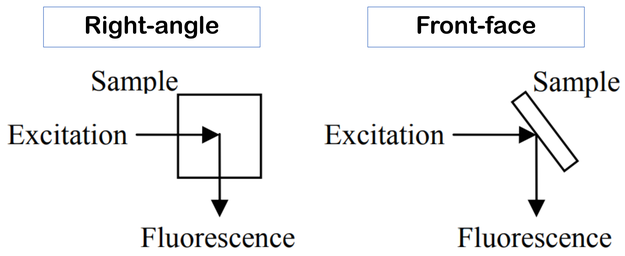

Figure 4. Right-angle and front-face fluorescence spectroscopy [9].

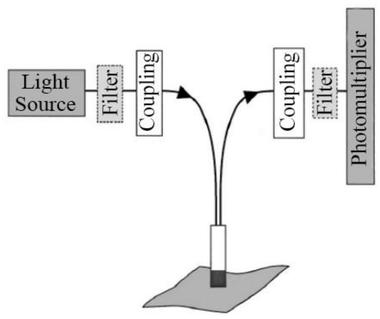

Figure 5. Spectroscopy system based on an optical fiber sensor, separating the excitation light and the emission light [10].

Fraud → economically driven

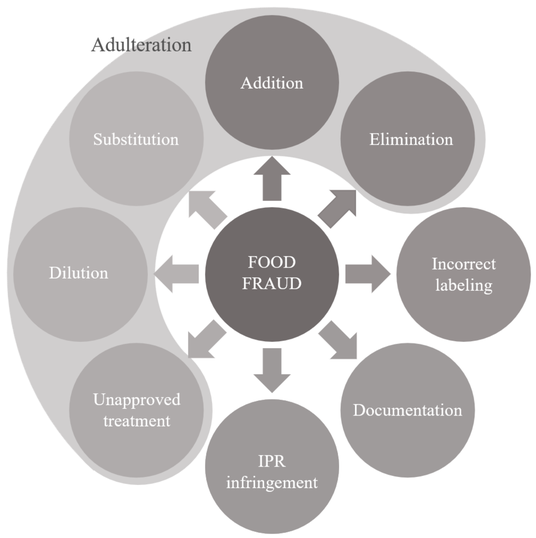

Figure 1. Types of food frauds [1].

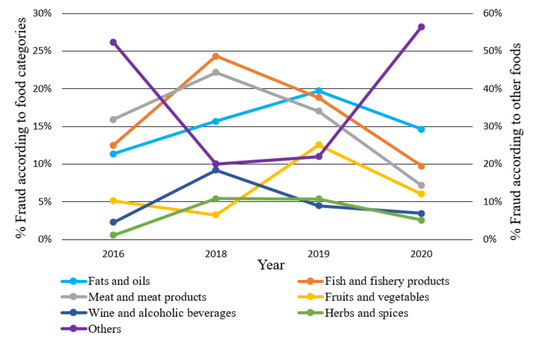

Figure 2. Evolution of the proportion of fraud according to food categories in 2016-2020 [2,3,4,5,6,7,8].

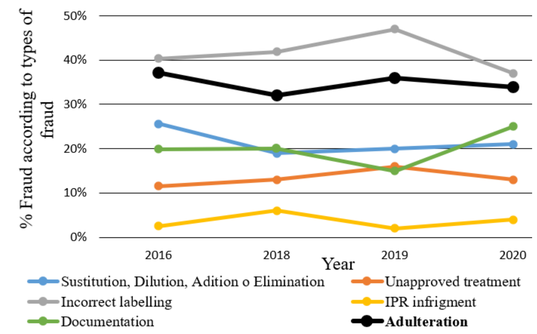

Figure 3. Evolution of the proportion of frauds according to their types of fraud in 2016-2020 [2,3,4,5,6,7,8].

Results

Table 1. Classification of studies that detect fraud applying front-face fluorescence [11,12,13,14,15,16,17,18].

Food Groups	Food	Studies
Fats and oils	Oil	Potential of front face fluorescence spectroscopy and fluorescence imaging in discriminating adulterated extra-virgin olive oil with virgin olive oil
Fish and fishery products	Tuna	Identification and quantification of tuna species in canned tunas with sunflower medium by means of a technique based on front face fluorescence spectroscopy (FFFS)
Wine and alcoholic beverages	Wine	Exploiting combined absorption and front face fluorescence spectroscopy to chase classification: A proof of concept in the case of Sardinian red wines
Herbs and spices	Turmeric	Fluorescence quenching by competitive absorption between solid foods Rapid and non-destructive determination of maize flour adulterated in turmeric powder
Milk and dairy products	Milk	Potentiality of using front face fluorescence spectroscopy for quantitative analysis of cow milk adulteration in buffalo milk
Honeys and royal jellies	Honey	Detection of Adulterated Honey by Fluorescence Excitation-Emission Matrices
Cereals and bakery products	Flour	Rapid, simultaneous and non-destructive determination of maize flour and soybean flour adulterated in quinoa flour by front-face synchronous fluorescence spectroscopy
Non-alcoholic beverages	Juice	Detection of orange juice frauds using front-face fluorescence spectroscopy and Independent Components Analysis

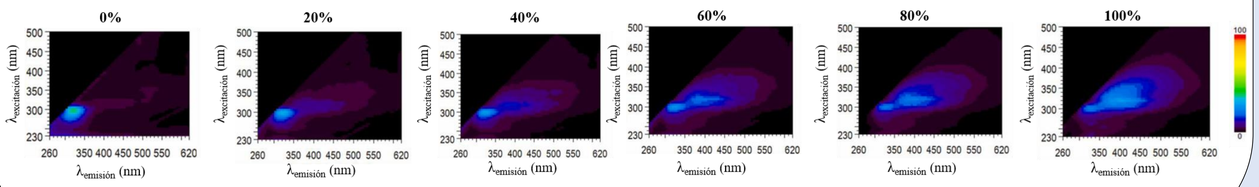

Figure 6. Excitation-emission matrices of extra virgin olive oil adulterated with a percentage of virgin olive oil (%) [11].

Conclusions

- An increase in fraud detection in the EU is shown in recent years, with better organization.
- The FFFS shows great potential for the detection of fraud in solid and cloudy liquid foods in an economical and non-invasive way. Especially adulterations. Still, more studies are needed in different foods.
- There are fiber optic probes that allow in/on-line measurement of FFFS. Even so, more studies are needed to prove its efficiency.

Bibliography

UAB