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Review

Polyphenols as Possible Candidates in the Study of Traceability of Food Chain – Short Review

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Abstract

This study aims a short reviewing destined to emphasize the usefulness of using polyphenols as traceability food markers. Food traceability practices also represent a useful tool in reducing risk against health safety issues, mainly those that may be produced by different pathogens affecting both plants and animals used as raw material for food production. Among these we mention that these regulations are the base of labelling the food product with the labels PDO, or PGI. A series of definitions have been developed of traceability. The food traceability needs the use of specific tools represented by the traceability markers. In the meantime, analytical markers are usually considered as specific chemical and/or biochemical compounds that possesses specific features, which by measuring deliver useful information that make it useful for measuring. A particular class of compounds have been proved a useful markers for food traceability. They belong to the polyphenols family. They are generally considered secondary metabolites being part of the group of and they have in common the phenolic group, meaning the simple aromatic ring (benzene) and one or more hydroxyl groups.

Keywords: *chemical methodology, DNA, marker, standard.*

1. Introduction

The problem of the food quality is one of the most important issue of our times, not only from the point of view of the common consumer, but also from the point of view of producers, retailers, distribution chain etc. In this aim a series of official regulations, guidelines, or recommendations destined to facilitate the implementation of norms in assuring not only the possibility of identification of food origin, but also to verify the food product authenticity, and/or correct labelling [15]. Food traceability practices also represent a useful tool in reducing risk against health safety issues, mainly those that may be produced by different pathogens affecting both plants and animals used as raw material for food production [4, 12, 17].

In the field of food traceability, a series of policies have been developed worldwide.

The main reason is not the food quality, but the risk arisen from the possibility of crisis produced by accidental diseases, as the case of bovine spongiform encephalopathy, which affected cattle and produces a series of harmful effects in some regions, not only from the point of view of health, but also from economic point of view.

In this respect, another accident from the point of view of human health is that produced by dioxin contamination [18, 16].

In this respect, we can mention the usefulness of international standards and certification tools (e.i. ISO 9000 series, Fig. 1) destined to protect consumers [29].

Among these we mention that these regulations are the base of labelling the food product with the labels PDO, or PGI. PDO is the acronym for Protected Designation of Origin, and it is usually labelling the foods and/or feeds, which are

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prepared/produced in a certain specific areal, with particular technology, thus having verified regional specificity.

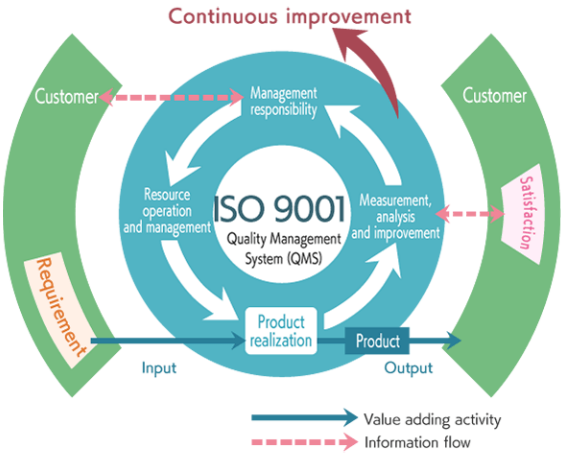

Figure 1. Illustration of implementation of ISO 9001 (Source: https://www.keyence.com/ss/products/marking/traceability/ law_basic.jsp)

PGI is the acronym for Protected Geographical Indications, and it mainly describe the origin areal of the product [4, 7, 15].

2. Traceability

Thus, according to International Vocabulary of Basic and General Terms in Metrology, traceability may be defined as *"property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties,* while Codex Alimentarius defines traceability as "*the ability to trace the history, application, or location of an entity by means of recorded identifications*; and European Commission (EC) defines it as "*the ability to trace and follow a food, a feed, food-producing animal of substance intended to be, or expected to be incorporated into a food or a feed, through all stages of production, processing and distribution.*" [10, 3, 13].

3. Traceability markers

The food traceability needs the use of specific tools represented by the traceability markers. According to European Medicine Agency (EMA), markers "*are chemically defined constituents or groups of constituents of a herbal substance, a herbal preparation or a herbal medicinal product which are of interest for control purposes independent of whether they have any therapeutic activity. Markers serve to calculate the quantity of herbal substance(s) or herbal preparation(s) in the herbal medicinal product if the marker has been quantitatively determined in the herbal substance or herbal preparation*". In this respect, EMA considers that two categories of markers may be distinguished, analytical and active, respectively. "*Analytical markers are constituents or groups of constituents that serve solely for analytical purposes. Active markers are constituents or groups of constituents which are generally accepted to contribute to the therapeutic activity*." In the meantime, analytical markers are usually considered as specific chemical and/or biochemical compounds that possesses specific features, which by measuring deliver useful information that make it useful for measuring [3, 6, 13, 28]. Such a marker is useful if it complies a series of requirements (Fig. 2)

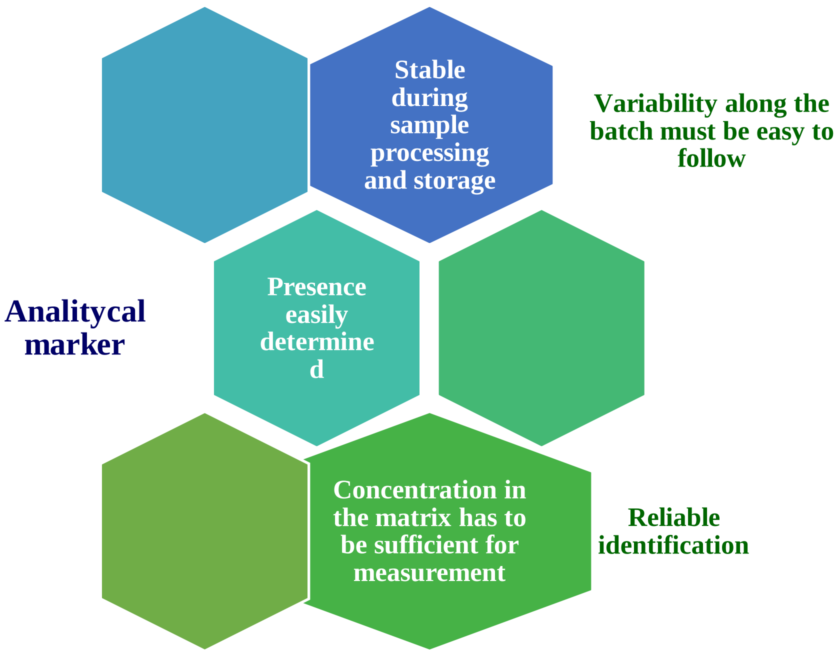

Figure 2. Analytical markers: Requirements for suitability

4. Polyphenols as markers

A particular class of compounds have been proved a useful markers for food traceability. They belong to the polyphenols family. They are generally considered secondary metabolites being part of the group of and they have in common the phenolic group, meaning the simple aromatic ring (benzene) and one or more hydroxyl groups. Among these compound we may exemplify:

- The group of flavonoids [16, 23] – flavone, flavonol, flavanone, flavan, flavanol, flavanonol, isoflavone, anthocianidin, flavan-3,4-diol, etc. (Fig. 3).

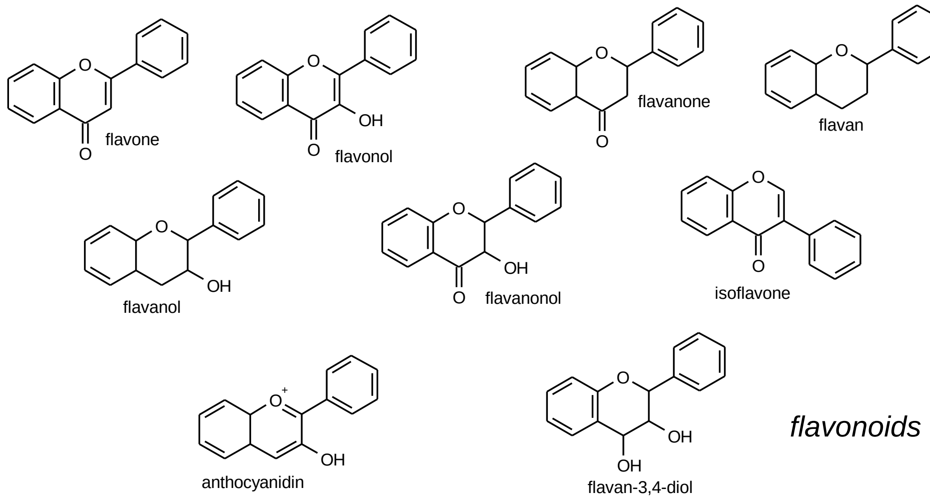

Figure 3. Flavonoids

- The group of organic acids [28] – protocatechiuc acid, p-coumarinic acid, caffeic acid, rosmarinic acid, gallic acid, sinapic acid, chlorogenic acid, etc. (Fig. 4).

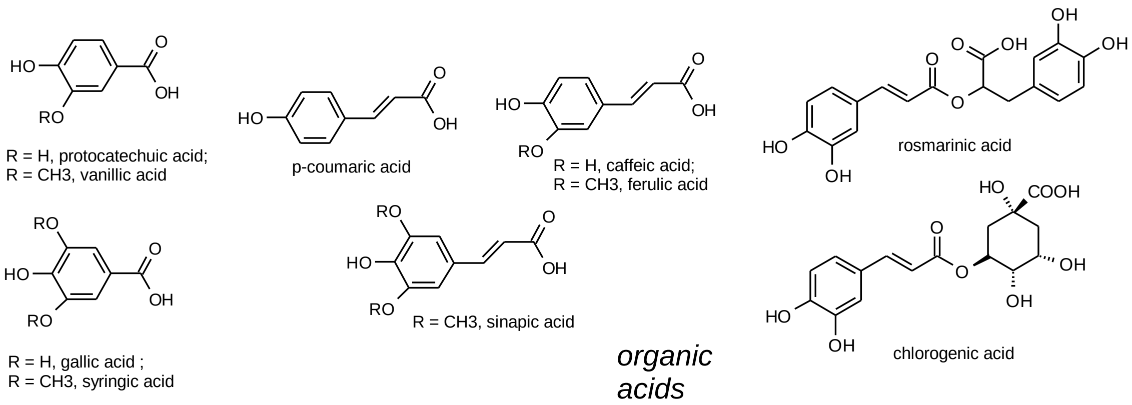

Figure 4. Organic acids

- The group of stilbenoids [14] – resveratrol and dihydroresveratrol (Fig. 5)

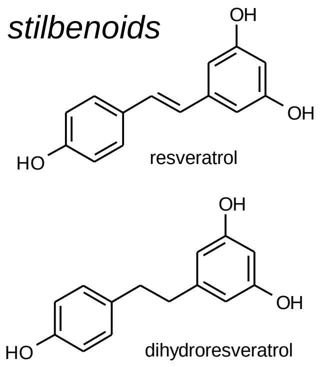

Figure 5. Stilbenoids

- The group of capsaicinoids, polyphenol amides [22] , respectively – capsaicin and dihydrocapsaicin (Fig. 6)

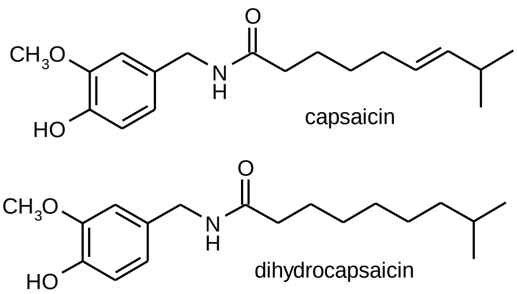

Figure 6. Capsaicinoids

- Curcumin, carnosal, carnosic acid [22] (Fig. 7)

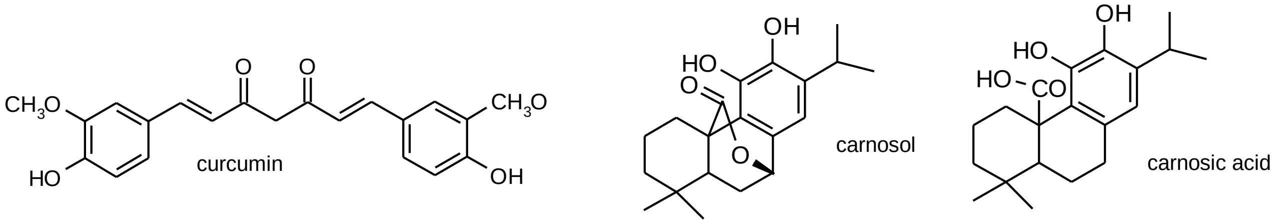

Figure 7. Curcumin, carnosal, carnosic acid

5. Methodologies

A series of methods have been developed in order to identify the polyphenolic markers traceability. All methodology must comply with method validation criteria, meaning it must be: accurate, selective, efficient, reliable, and reproducible. One of the most valuable are those involving DNA markers. Among these methods we mention: single nucleotide polymorphisms (SNP), microsatellites or simple sequence repeats (SSRs), restriction fragment length polymorphisms (RFLPs), random amplification of polymorphic DNAs (RAPDs), amplified fragment length polymorphisms (AFLPs), etc. [9, 18, 24, 25, 27]Among chemical methodologies one may emphasize methods with different degrees of complexity: ultraviolet-visible spectroscopy (UV-Vis), liquid chromatography coupled with mass spectrometry (LC/MS), gas chromatography coupled with mass spectrometry (GC/MS), nuclear magnetic resonance (NMR), inductively coupled plasma mass spectrometry (ICP/MS), near-infrared spectroscopy (NIR), etc. [2, 6, 8, 11, 15, 19, 20, 21, 22, 26]. The methodologies that use of isotopes are also implemented [1, 5].

6. Conclusions

The problem of food and feed traceability is one of the top issues within the larger problem of food and feed safety, with high importance for both humans and animals. For this reason a series of methodologies are developed. They all have in common the use of markers. Among the marker categories an important role is played by phenolic markers. The have been proofed to be a very powerful tool destined to investigate the traceability of food and feed of both vegetal and animal origin.

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