13. INTRODUCTION TO NATURAL FOOD INGREDIENTS IN FOOD INDUSTRY.

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13.1 CONCEPTS AND CHARACTERISTICS

After decades of debate there remains no generally accepted definition of a "natural" food product. Regulatory agencies have refused to settle the issue but may be under new pressure from consumer lawsuits, according to a new study in the Journal of Public Policy & Marketing (Spring 2015). "Consumers don't agree on a definition either, yet clearly believe that 'natural' is important," writes author Ross D. Petty (Babson College). "In 2009, 30% of newly launched foods claimed to be natural but by 2013 this dropped to 22%, possibly due to an increase in the number of consumer lawsuits. Lawyers are increasingly willing to take cases which regulatory agencies have abandoned." Source: American Marketing Association

People have been using natural products since de origins of human history. Only at the end of the 19th century we have started to know something about the chemistry of these products. With our increasing knowledge about chemistry and related sciences, we have begun to synthesize some of the natural chemicals and also to modify some of these compounds and sometimes we have developed completely new ones. Consequently, since the beginning of the Synthetic Era several

decades ago, many natural drugs have been replaced by synthetic ones; natural flavours and fragrances have been duplicated or simulated by non natural chemicals.

However, the number of natural products or derived from natural products drugs used in pharmaceutical products is still sizable, amounting around 25% of the total number of medicines approved by FDA (USA). This number has not changed appreciably for the last decades, especially with reference to botanicals. At least 250 plants or their extracts are currently used in commercial food products broadly classified as flavoring ingredients according to the Flavor and Extract Manufacturers Association of the United States (FEMA).Over the past decade there has been an increasing interest in the use of natural products particularly in foods, cosmetics, and complementary medicine, especially after the passage of the Dietary Supplement Health and Education Act (DSHEA) in 1994. The implementation of DSHEA in the United States opened the market to a new class of natural-based products that are collectively known as dietary supplements.

Ingredients used in foods, drugs and cosmetics can be divided into two main categories, namely, active and inactive. Active ingredients can be considered as those that supply energy to the body or serve as its nutrients (foods and some food additives), or cause physiological changes in or on the body (drugs and cosmetics) when taken internally or applied externally. Inactive (inert) ingredients are substances that, based on prevalent data, do no exert physiological actions when ingested or applied to the body. Their primary function is to act as diluents (fillers) and/or to facilitate the ultimate intake or utilization of the active ingredients. Among food products, basic foodstuffs such as flour, starch and milk are considered active ingredients.

Food additives are a large group of substances that are added to foods either directly or indirectly during the growing, storage or processing of foods for one or more of the following purposes:

1. Improve or maintain nutritional value
2. Enhance quality
3. Reduce wastage
4. Enhance consumer acceptability
5. Improve keeping quality
6. Make the food more readily available
7. Facilitate preparation of food

Natural ingredients are derived from natural sources (e.g., soybeans and corn provide lecithin to maintain product consistency; beets provide beet powder used as food colouring). Other ingredients

are not found in nature and therefore must be synthetically produced as artificial ingredients. Also, some ingredients found in nature can be manufactured artificially and produced more economically, with greater purity and more consistent quality, than their natural counterparts. For example, vitamin C or ascorbic acid may be derived from an orange or produced in a laboratory. Food ingredients are subject to the same strict safety standards regardless of whether they are naturally or artificially derived.

While it is true that there is no official, U.S. government regulated definition for the term natural pertaining to the natural products industry, the FDA refers to natural ingredients as "ingredients extracted directly from plants or animal products as opposed to being produced synthetically."

The key word there is, "extracted directly". In the case of some ingredients, it's easy to see that they fit easily into this definition but in other cases it is more complicated.

But what about raw materials that need to undergo some processing or chemical reaction in order to extract the ingredient from the natural raw material that is the source?

Even distilling aromatic plants to produce essential oils sometimes results in the creation of chemicals that didn't exist in the raw material, but which are created by the actual distillation process alone.

The "Encyclopedia of Common Natural Ingredients" says a natural product is defined as a "product that is derived from plant, animal or microbial sources, primarily through physical processing, sometimes facilitated by simple chemical reactions such as acidification, basification, ion exchange, hydrolysis, and salt formation as well as microbial fermentation."

In the early '80s the Federal Trade Commission (United States) came up with a great definition for Natural – never adopted. They said that an ingredient may be called "natural" only if it contains no artificial or synthetic ingredients and has had no more processing than something which could be made in a household kitchen.

NIs could be described as substances or mixtures of natural substances of vegetable or animal origin, that, based on their unique molecular structure, at given doses and in certain foods, are able to give health properties to the food, such as those listed in Regulation (EC) 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods, in which Article 13 speaks about reducing body weight, decreased appetite and / or

increasing satiety, physiological and biological improvements, behavioral improvements; and in Article 14, about reducing the risk of suffering diseases and the development and health of children.

According to the Natural Ingredient Resource Centre (www.naturalingredient.org) Natural Ingredients are:

- grown, harvested, raised and processed in an ecological manner.
- not produced synthetically.
- free of all petrochemicals.
- not extracted or processed using petrochemicals.
- not extracted or processed using anything other than natural ingredients as solvents.
- not exposed to irradiation.
- not genetically engineered & do not contain GMOs (genetically modified organisms).

Natural ingredients do:

- not contain synthetic ingredients.
- not contain artificial ingredients including colours or flavouring.
- not contain synthetic chemical preservatives

13.2 CLASSIFICATION OF NATURAL INGREDIENTS

Natural Ingredients NIs include:

- plant, animal, mineral or microbial ingredients
- present in or produced by nature
- produced using minimal physical processing
- directly extracted using simple methods, simple chemical reactions or resulting from naturally occurring biological processes.

Natural Ingredients are substances and natural extracts, mainly from plants, fruits, vegetables, tubers and other botanical specimens, as well as from animal origin foods, which have both health benefits and technological effects (improving the colour, smell, taste, stability, texture and shelf life of foods) when intentionally added to vegetable or animal origin foods at a given dose.

It could be said that NIs are multifunctional, capable of improving healthy characteristics, quality and performance of food substances. Its use allows to reduce and sometimes to eliminate the use of some synthetic additives, improving the characteristics of all kinds of food.

There is no official classification for Natural Ingredients, and the expression is not official, but it helps us to understand and to explain, in a simple and transparent manner, properties, utilities and applications. There are a small number of NIs when compared with synthetic food additives; and there have not been identified valid NIs for all technological functions, but it is a fact that every day the number of Natural Ingredients is growing and the trend is to grow significantly in the coming years mainly due to consumers and market exigencies.

Natural Ingredients can have technological effects: colouring, sweetening, regulate the acidity, act as antioxidants, preserve, enhance the flavour, etc.

Natural Ingredients can be classified into:

- Natural colourings
- Natural sweeteners
- Natural acidity regulators
- Natural antioxidants
- Natural preservatives and antimicrobials
- Natural flavour enhancers
- Natural functional ingredients
- In study: anti foams, emulsifiers and stabilizers.

The NI effect depends basically on the three following points:

- Molecular structure. It is widely known that the molecular structure and, more specifically, the presence of certain functional groups in the molecules and the presence of optical isomers, enhance specific technological actions, besides confer beneficial effects to food, such as improving the metabolism of carbohydrates, fats and proteins, reduce cholesterol (hypocholesteremic), lower blood pressure, improve cardio vascular health, enhance the immune system, promote liver and kidney health, prebiotic effects, probiotic effects , increase satiety, reduce fat (hypolipidemic), among other advantages.
- Effective dose. This is the minimum amount necessary to produce the desired technological effect.

- Type of food. Specific type of food to which the bio-additive is added.

The most demanded NIs are those with antioxidant and/or antimicrobial effects (they will be studied in depth in the next chapter). The main reason is the "bad press" especially around some excellent synthetic preservatives like benzoates (bacteriostatic, inhibiting the growth and development of bacteria) and p-hydroxy benzoate (fungistatics, which inhibit the growth and development of fungi). Although they are authorized in some foods (fruit jams, some canned vegetables, canned meat, etc.), there are many reports, articles, etc., raising suspicions and negative comments, about their potential toxicity. Hence the "need for natural alternatives for food preservation"; that is, the need for natural ingredients (natural preservatives) to provide consumers with other procedures based on natural ingredients or extracts to preserve foods.

A clear example of the trend for the future of Natural Ingredients is certainly rosemary extract, which has been granted an E number for use as an additive: E392, having officially joined the EU list of food additives (Regulation EU No 1129/2011). Only in this case there is an official classification or description with scheduled doses of use, field of application, criteria of identification and purity, identification and quantification methods, etc.

Natural Ingredients may be used not only in the food itself, but also in the composition of plastic containers, plastic films, etc., for the development of active containers and packaging.

In this research area, CTC was partner of the Spanish project: DEVELOPMENT OF NEW ACTIVE CONTAINERS WITH NATURAL ADDITIVES FROM AGROFOOD WASTES 2009/2011, Acronym: NATAL

The consortium was integrated by seven Spanish technological centres specialized in plastics and all kind of food products (meat, fish, fruit and vegetables, etc.)

Objectives

- Getting active, barrier and flexible packaging and separator films, both with natural anti-microbial and / or antioxidant additives from natural agroindustrial wastes. These containers and films must be applicable in a wide range of food preservation processes, extending their shelf lives.
- Obtaining natural extracts and study of their antimicrobial and / or antioxidant efficacy.
- Development of thermoplastic compounds from natural additives.

- Development of flexible active packaging to different foods and subsequent processes of conservation.
- Development active separators specific for sliced food

Different natural additives and types of food were studied, table 13.1 and table 13.2.

Table 13.1: Natural additives from agroindustrial wastes, NATAL project	
Additives (active principle)	Action
Onion extracts (quercitin and other flavonoids)	Antioxidant and antimicrobial
Pepper extracts	
Grape extracts (poliphenols)	
Alperujo extracts (poliphenols)	
Tomato skin extracts (lycopene)	Antioxidant
Seaweed extracts (ascorbic acid and tocopherol)	
Papaya extracts (papaina)	
Garlic extracts (organosulphurate)	Antimicrobial

Table 13.2: Food and containers studied within NATAL project		
Food and technology	Active container	Protection
Slices of cooked ham (soft pasteurization)	Barrier and flexible packaging and separator film	Antimicrobial
Smoked salmon (refrigeration)		
Swordfish (sterilization)	Barrier and flexible packaging	
Slices of aged cheeses (refrigeration)		Antioxidant
Sliced cured Iberian pork meat (refrigeration and modified atmosphere)	Barrier and flexible packaging and separator film	
Fresh meat of Iberian pork (refrigeration and modified atmosphere)		Antioxidant and antimicrobial
Sliced cheeses (refrigeration)		
Fresh salmon (refrigeration)		
Sliced fruit and vegetables (refrigeration)	Barrier and flexible packaging	

13.3 INDUSTRIAL USE OF NATURAL FOOD INGREDIENTS: TYPES, FUNCTIONAL INGREDIENTS, CLEAN LABEL.

One of the keys to success when developing a food product is to know the various basic ingredients that are added to foods, as well as how they're used. The most extended Natural Ingredients in the

food industry are: Flavours, Colorants, Antioxidants, Antimicrobials, Stabilizers and Acidity regulators. For functional foods are of high importance the Natural functional ingredients. All of them give the industry the option to use the Clean Label with the important benefits that this implies.

Flavours

Natural flavours can be used in all the food and beverage industries: bakery, confectionery, dairy goods & ice cream, soft & alcoholic drinks, savoury products (ready meals, pies, soups, snacks, etc.) and many other industry sectors. There is in the market an extensive range of natural (From The Named Fruit FTNF, With Other Natural Flavour WONF, esters) and nature identical flavours. Fruit Aromas (esters) are made from distilling the volatiles from the Fruit Juice Concentration process. Around 150 kg of fruit is required to produce 1kg of Aroma. Fruit Aromas like these can be re-added to Juice Concentrates and to finished products without declaration. They are generally only used in the beverage industry for both alcoholic and soft drinks.

Flavours are available in liquid; spray dried encapsulated powder and emulsion forms. For some applications, like bakery, they have to be tested to remain stable in the very high temperatures and stresses of the manufacturing processes.

Natural colours and extracts

Natural colours and natural extracts are both healthy and help food to look its most delicious. Any chef will tell that “we eat with our eyes first”, which means the appearance of food is as important as the taste. Natural colours are designed specifically to enhance the look of food, while keeping it healthy and natural, for the majority of applications and technological processes.

Unlike colours, natural extracts (including botanical and herbal extracts) are multi-functional as they combine colour with flavour and natural antioxidants to create a well-rounded food enhancing product. It has to be ensured that pH, dosage level, exposure to light and processing temperature are all correct.

Natural extracts and colours can be found in different strengths and solubility to suit every technological process and food product (water soluble, oil soluble and spray dried forms).

Natural antioxidants (more information in next chapter)

Natural antioxidants provide an effective alternative to the synthetic antioxidants traditionally used in the food industry. It is well known that antioxidants play a key role in maintaining the flavour

and colour integrity of food products, but natural antioxidants also help protect the nutritional quality of food. With several different naturally-sourced options available, these label-friendly products can be used in a large variety of applications to keep your foods tasting better, looking better and lasting longer.

The demand for natural antioxidant active packaging is increasing due to its unquestionable advantages compared with the addition of antioxidants directly to the food. Therefore, the search for antioxidants perceived as natural, namely those that naturally occur in herbs and spices, is a field attracting great interest. In line with this, in the last few years, natural antioxidants such as vitamin E (α-tocopherol), hydroxitirosol, catechin, quercetin, resveratrol and plant extracts (e.g. rosemary extract) have been incorporated into food packaging. On the other hand, consumers and the food industry are also interested in active biodegradable/compostable packaging and edible films to reduce environmental impact, minimise food loss and minimise contaminants from industrial production and reutilisation by-products.

Natural antimicrobials (Bacteriocins)

Bacteriocins are antibacterial proteins produced by bacteria that kill or inhibit the growth of other bacteria. Many lactic acid bacteria (LAB) produce a high diversity of different bacteriocins. Though these bacteriocins are produced by LAB found in numerous fermented and non-fermented foods, nisin is currently the only bacteriocin widely used as a food preservative. Many bacteriocins have been characterized biochemically and genetically, and though there is a basic understanding of their structure–function, biosynthesis, and mode of action, many aspects of these compounds are still unknown.

Bacterial fermentation of perishable raw materials has been used for centuries to preserve the nutritive value of food and beverages over an extended shelf-life. In a number of food fermentations, the key event is the conversion of sugars to lactic acid by lactic acid bacteria (LAB, which include the genera Lactococcus, Streptococcus, Lactobacillus and Pediococcus, among others). Lactic acid and other end products of LAB metabolism, including hydrogen peroxide, diacetyl, acetoin and other organic acids, act as bio-preservatives by altering the intrinsic properties of the food to such an extent as to actually inhibit spoilage microorganisms. While the role of these metabolic end products has long been appreciated, the contribution of LAB-derived bacteriocins may frequently have been overlooked. The widespread ability of LAB to produce bacterocins implies an important biological role maintained over many generations and the precise nature of this

role has been the subject of intensive research in recent times. Bacteriocin production could be considered as advantageous to the producer as, in sufficient amounts; these peptides can kill or inhibit bacteria competing for the same ecological niche or the same nutrient pool. This role is supported by the fact that many bacteriocins have a narrow host range, and are likely to be most effective against related bacteria competing for the same scarce resources.

Bacteriocins can be incorporated into foods as a concentrated, though not purified, preparation made with food-grade techniques. For example, NisaplinTM is prepared by initially fermenting non-fat milk with a nisin producing Lactococcus lactis. The resulting fermentate is subsequently concentrated and separated, spray dried and milled to yield small particles. The end product has found many applications in food processing. Nisin has been found to be extremely effective as an additive to prevent spoilage and increase shelf-life in a number of foods

The chemical and physical properties of a food, e.g. pH, and fat content, can also have a significant role in the suitability of a particular bacteriocin. This is exemplified by the fact that nisin is very active at acid pH, but loses activity above pH 7 (Delves- Broughton, Blackburn, Evans, & Hugenholtz, 1996), whereas another lactococcal ,producing lantibiotic lacticin 3147, retains activity at neutral pH and significantly is particularly heat stable at low pH (McAuliffe et al., 1998). It should also be noted that nisin is generally not as effective in the preservation of meat as it is in dairy products. This is thought to be due to interference by meat components such as phospholipids that limit its activity, especially where there may be a high-fat content.

Natural stabilizers

Chemical modification of gums and starches is widely performed to improve functionality and enhance stabilizing properties. However, the modified compounds can no longer be claimed as natural. U.S. definitions of the term are strict, especially as applied to stabilizers.

Natural gums and starches are not chemically modified, just isolated from the plant to obtain a concentrated. For centuries, we have derived hydrocolloids from products biosynthesized naturally by plants. Typically, after isolating and elucidating the chemical structure of specific components, such as alkaloids, colours and flavouring agents, from the natural source, processors develop methods to synthesize chemically identical compounds in vitro. However, for starch and gum polysaccharides, it is more economical to isolate and purify the high-molecular-weight polymers from the original plant sources made available to man by Nature, typically from plants and seaweeds.

Hydrocolloids, commonly known as water-soluble gums and starches, are high-molecular-weight plant polysaccharides. After isolation from the plant, gums and starches are converted to powders with low (10% to 12%) moisture content, so they do not require preservatives if stored under proper conditions.

Naturally occurring water-soluble gums exhibit a wide variety of functions: thickening, texturizing, film-forming, water-binding and/or gelling properties, given specific conditions. The properties of these complex carbohydrates are affected by many factors: functional groups as constituents; molecular size; orientation and molecular association; water-binding and swelling; concentration; particle size; and degree of dispersion.

Table 13.3: Natural Gums

Plant Source	Family/Class	Common Name	Polysaccharide Units	Uses
Senegalia Acacia	Leguminoseae	Gum acacia or gum arabic	Galactoarabinan	Emulsifying agent, stabilizer
Macrocystis Laminaria spp.	Phaeophyceae (Brown seaweeds)	Alginate	Polynanuronic/ polygluconate	Gelling agent
Eucheuma spp. Chondrus spp. Gigartina spp.	Rhodophyceae (red seaweeds)	Carrageenan	Anhydrogalactose sulfate	Gelling agent, suspending agent
Gelidium, Gracilaria	Rhodophyceae	Agar	Anhydrogalactose	Gelling agent
Cyamopsis tetragonolobus	Leguminoseae	Guar gum	Galactomannan	Thickener
Ceratonia siliqua	Leguminoseae	Locust bean gum	Galactomannan	Thickener

Source: http://www.foodproductdesign.com/articles/2007/10/stabilizers-naturally.aspx

Natural hydrocolloid gums can serve as good sources of soluble dietary fibre (about 85% on a dry basis). The soluble fibre has been reported to lower serum cholesterol and improve gastrointestinal function and glucose tolerance.

Gums are also virtually free of fat or oil, contain very little protein and have low moisture content. They consist primarily of complex carbohydrates derived from plants or from the biosynthesis of end products by microorganisms (e.g., xanthan gum). Seaweed extracts also contain an appreciable level of ash, which may naturally occur with the gum or may result from processing.

Natural gum stabilizers include hydrocolloids that "come from natural sources and are processed by natural means, such as mechanical or heat extraction, water extraction and not by chemically reactive processes". "Such natural hydrocolloids include agar, sodium alginate, carrageenans, guar, konjac, tragacanth, locust bean gum, psyllium, tara gum, fenugreek gum and xanthan gum". Source: Gum Technology Corporation, Tucson, AZ

Starches are generally considered natural ingredients, except when the plant is genetically modified or the starch itself is chemically altered. Processors use wet milling to extract and liberate the starch by grinding aqueous slurries of the raw material. Purification of natural starches is achieved by nonchemical procedures. The extracted starch may be pregelatinized by heat treatment in the presence of water to make it cold-water soluble.

Starch is a polymer of glucose (dextrose) and is produced in the plant by a biosynthetic process. Two polysaccharide types occur in most starches: Amylose, a linear polymer, has the tendency to retrograde, and amylopectin, a highly branched polymer, does not easily undergo retrogradation. However, at freezing conditions, amylopectin's clarity decreases and its water-holding capacity is reduced. Retrogradation is the realignment of amylose and amylopectin chains after gelatinisation occurs. It occurs at lower temperatures and produces a crystalline structure. Retrogradation causes liquid to turn into a form of gel. In table 13.4 are shown the percentage of Amylose and gelatinization of unmodified starchs from different plants.

Table 13.4: Unmodified Starches From Plant Sources

Starch	Source	Amylose (%)	Gelatinization (ºC)
Corn (Zea species)	Cereal	22 to 28	62 to 72
Waxy maize	Cereal	<1	62 to 72
Rice	Cereal	16 to 17	68 to 78
Wheat	Cereal	17 to 27	58 to 64
Tapioca	Root	17 to 22	62 to 73
Potato	Root	23	59 to 68
Sago	Pith	26	ND*

Food-grade starches come from corn, tapioca, potato, rice, sorghum, wheat and other cereals, and from roots, e.g., potato and tapioca. Potato and tapioca starches have relatively higher molecular weight than cereal starches and, at low temperature, have less of a tendency to undergo retrogradation (e.g., crystallization).

Unmodified starches have a maximum limit of 0.5% protein, except in high-amylose starches, and crude fat must not exceed 0.15%. Moisture content of cereal starches cannot exceed 15%, and tapioca and sago starch cannot exceed 18%.

Gums and starches are highly functional ingredients in snack foods, beverages, cereal products and other food systems mainly due to viscosity, water-binding and gelling properties. Viscosity ranges of hydrocolloids can vary significantly (from 10 cps to 4,000 cps at 1% gum content) due to their chemical nature, degree of branching and polymerization.

Hydrocolloid gums, when combined with unmodified starches, can help increase moisture retention, reduce ice crystal growth, act as suspending and adhesive agents, inhibit weeping (syneresis), stabilize foam and emulsions, and improve freeze/thaw stability. Some seaweed extracts, such as agar, carrageenan, pectins and alginates, work as gelling agents in jams, pie fillings, icings and glazes. As a source of fiber, gums such as gum acacia, pectin (lemon pectin) and guar gum can be used at levels compatible with the end product.

Unmodified starches, with and without pregelatinization, do not have maximum limits of usage. However, the Code of Federal Regulations specifies the maximum use level of gums by various product categories (e.g., bakery, snack foods, salad dressings, confections, etc.). The gum is usually mixed in with the flour in dry mixes. In beverages, sauces and dressings, the gum is allowed to hydrate at the required conditions of temperature, pH, ionic requirements and other cofactors, based on supplier recommendations. The sequence of incorporation, synergy, particle size and chemical nature of the polysaccharide also affect the hydration rate.

When some specific gums are used in combination, it significantly enhances or modifies the functional properties due to synergistic action. For example, a combination of xanthan gum and locust bean gum forms a heat-reversible flexible gel, whereas the individual gums are not gel-forming. The reaction of locust bean gum with kappa carrageenan to yield heat-reversible rigid gels works as a gelling agent in baked goods, desserts and confections. Gums and starches are typically combined in a formulation, since the gums generally help reduce retrogradation problems involved with high-amylose starches.

Natural acidity regulators.

Acidity regulators, or pH control agents, are food additives added to change or maintain pH (acidity or basicity). They can be organic or mineral acids, bases, neutralizing agents, or buffering agents.

Natural acetic (vinegar), citric (lemon), malic (apple), etc., acids may be found for their use in the food industry.

Functional Ingredients

Functional Ingredients are natural ingredients that have:

- Health-promoting
- Energy boosting and/or
- Disease preventing benefits

They have gained increasing popularity in the food industry, and there are a surprising range of benefits available.

Bioflavonoids are chemical compounds related to vitamin C. They act as antioxidants and their many health benefits include increasing the effectiveness of vitamin C, helping to maintain healthy blood vessels and aiding the body in iron absorption. They can come from orange, lemon, grapefruit, mix of citrus, rosemary, etc.

Nutraceuticals. The word is a contraction of nutrients and pharmaceuticals which hints at their functional nature. These products are widely used in health food, functional drinks and pharmaceutical applications. The consumption of Nutraceuticals are claimed to improve the overall health and well-being of a person.

Phytonutrients are health-supporting compounds found in fruit, vegetables, nuts and herbs. They are used in functional foods and are known as a specific category of nutraceuticals. They act specifically as antioxidants, cholesterol fighters or immune boosters.

To validate and verify the functionality of bioactive components of a natural ingredient is important to perform bioavailability and functionality studies in vitro to have scientific evidence that they really work.

Many of these bioactive compounds in foods need protection. This protection against factors such as the pH is done through techniques such as microencapsulation. For example, probiotics are microencapsulated to be implanted in the intestine.

Agrobiotec, company belonging to Matarromera Group, has studied bioavailability of polyphenolic compounds from extracts of grape for incorporation in various foods, such as bread. They are studying the synergies and mechanisms of action of different bioactive compounds in certain products such as bread, milk and eggs to increase their shelf life.

Clean Label

Labels with fewer additives and ingredients as much natural as possible: They are called "clean labels", one of the most frequent demands by consumers today. To reduce the amount of numbers "E" and to incorporate “free” claims. But it is not easy to adapt food products to this demand, without this implying lower the quality of the products and without this implying an additional cost.

Consumers increasingly check what they buy, choosing between the more natural foods. In fact 70% of consumers select the list of ingredients as one of the most important aspects when choosing a food product. It is significant that in the last five years the consumption of products with labels declaring “100% natural” or “free” have raised by 73% (Source GNPD Mintel)

To carry out a process of elimination of "E" additives it is needed to carry out a detailed study of the product and the technological process: identify and classify the "E" number being used, determine which ingredients are dispensable and which are necessary to ensure the organoleptic characteristics, search for natural alternatives with the same function than the additive, etc ...

Mintel Group, a market research company, showed a view of the current outlook for innovation mainly focused on setting the trend towards the launch of "natural" products. Specifically highlighted three main areas that are increasing their market penetration: health and welfare, the so-called "free from" products, such as gluten-free or low-lactose products and products intended for a senior audience.

Following this trend, food ingredients distributors companies are already offering alternatives to the agro food industry to substitute numbers 'E' for new applications of natural ingredients, in order to get the 'clean label'

13.4. LEGISLATION / STANDARDS

First it is necessary to clarify that the term "Natural" is a CLAIM, since it is not required on the label (product name, ingredients, expiration date ... are mandatory) to say whether it is "natural" or "artificial".

A claim is:

Any message or representation, which is not mandatory under European Community or national legislation, including any form of pictorial, graphic or symbolic representation, which states, suggests or implies that a food has particular characteristics.

In this case the specific characteristic that states / suggests / implies is that the food is "natural".

There are two types of claims:

- Nutritional claims
- Health claims

Nutritional claims are less controversial and are well defined. They tell that a food has beneficial properties either for their energy intake or nutrients. Example "light food, low salt, iron source ..."

Health Claims are much more controversial, because its message is much more commercial, due that they allege properties in improving health. EU Regulation 432/2012 lists the authorized Health Claims.

The term "natural" is included in the first type (of which are well defined), but in the European Regulation (EC) No. 1924/2006 “on nutrition and health claims made on foods” the term "natural" it is only said that “Naturally/Natural: Where a food naturally meets the condition(s) laid down in this Annex for the use of a nutritional claim, the term ‘naturally/natural’ may be used as a prefix to the claim”.

In 2013 the secretariat of ISO/TC 34 received from the Swiss Association for Standardization a New Work Item Proposal entitled “Definition of criteria for a food ingredient to be considered as natural”. The complete title of this standard (still draft in 2015) is “ISO/CD 19657. Definition of criteria for a food ingredient to be considered as 'natural' -- Guidelines on technical definitions and criteria for natural food ingredients”.

The purpose of this Standard is to provide the necessary standardized criteria for natural food ingredients that the food and beverage industry can refer to at a global basis at the time of the free circulation of goods around the world.

The standard offers technical solutions for all food companies, applicable to all organizations, regardless of size or complexity in a global food supply chain. It provides globally harmonized

instructions for the natural food ingredients in a responsible, reliable and competitive manner. Furthermore, it helps to harmonize the technical specifications of natural food ingredients.

This International Standard offers the reliable reference to consumers and food control authorities. Conformity to this standard provides the necessary criteria to assure integrity and coherence towards the public trust of consumers and food control authorities worldwide.

These guidelines provide technical definitions and the criteria for natural in terms of food ingredients and food processes. This standard applies to foods for human consumption. It does not apply to animal feed products.

The scope of these guidelines does not include “Natural Mineral Waters”, “Natural Flavourings” and “Organic” as these are defined by international (Codex) Standards.

It is important to highlight that product communication (e.g. claims and labeling), human safety and socio-economical considerations (e.g. fair trade) are outside of the scope of the guidelines. In addition, the characteristics of packaging materials are not included in the guidelines either.

Section 3 of the guidelines provides technical guidance on the criteria for the various components of food to be considered as natural. Food ingredients, additives, flavourings and processing aids, as well as carriers for these, as defined by Codex Standard, shall be considered natural in the scope of this Standard provided the following criteria are fulfilled:

- It is derived from a recognized source: Plant, Animal, Mineral or Micro-organism
- It is obtained by physical and/or enzymatic and/or microbiological processing as described in Annex A and B.

The USDA (United States of America) has a legal definition for “natural”, but it applies only to meat and poultry; “those products carrying the “natural” claim must not contain any artificial flavoring, color ingredients, chemical preservatives, or artificial or synthetic ingredients, and are only “minimally processed” defined by USDA as a process that does not fundamentally alter the raw product.”

The USDA National Organic Program defines non-synthetic as “a substance that is derived from mineral, plant or animal matter and does not undergo a synthetic process”. They define a synthetic as “a substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral

sources, except that such term shall not apply to substances created by naturally occurring biological processes."

Consumers Union, publisher of Consumer Reports, which is an independent, non-profit testing and information organization serving only consumers, states; "Natural is a general claim that implies that the product or packaging is made from or innate to the environment and that nothing artificial or synthetic has been added. There is currently no standard definition for the term except for meat and poultry products. Unless otherwise specified, there is no organization independently certifying this claim. The producer or manufacturer decides whether to use the claim and is not free from its own self-interest."

It should be needed a real, working definition for natural ingredients which can be used by consumers, manufacturers and retailers in the natural products industry; to promote the use of natural ingredients by offering news & resources to learn more about natural ingredients.

BIBLIOGRAPHY

Leung's Encyclopedia of Common Natural Ingredients. Used in Food, Drugs and Cosmetics. Third Edition. Ikhlas A. Khan, Ehab A. Abourashed. WILEY.

"Natural" Claims in Food Advertising: Policy Implications of Filling the Regulatory Void with Consumer Class Action Lawsuits. Ross D. Petty. Journal of Public Policy & Marketing, Spring 2015, Vol. 34, No. 1, pp. 131-141

COMMISSION REGULATION (EU) No 1129/2011of 11 November 2011 amending Annex II to Regulation (EC) No 1333/2008 of the European Parliament and of theCouncil by establishing a Union list of food additives

REGULATION (EC) No 1924/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 December 2006 on nutrition and health claims made on foods

ISO/CD 19657. Definition of criteria for a food ingredient to be considered as 'natural' -- Guidelines on technical definitions and criteria for natural food ingredients