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# What is a natural ingredient?

## A survey among the members of The International Scientific Advisory Board of *HPC Today*

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ABSTRACT: At a first glance, the concept of "natural ingredient" and the related concepts of "organic ingredient" and "green ingredient" seem to be quite clear and established. In our daily experience we are surrounded by offers of natural, organic or green products. Foods and beverages, pharmaceuticals, cosmetics, personal care products, household products and even cloths are more and more associated with one or more of these claims. Advertising and most media are telling us on a quasi daily basis that natural, organic and green products are healthier, more sustainable and therefore positive for our wellbeing and help to preserve the environment. But are these concepts really so clear and well established? Is it true that natural, organic or green is always healthier? Finally, is it true that these products are always more sustainable and help to preserve nature? What at a first gaze seems to be obvious to everyone becomes more and more undefined if we analyse these questions in more detail. What does natural, green or organic really mean from the scientific, technical, health improvement and sustainability points of view? Moreover, do natural ingredients have a efficacy comparable to their synthetic counterparts?

### INTRODUCTION

If we take a look at ancient cosmetics used by Egyptians or Romans two thousand and more years ago, there is no doubt that these were produced in a sustainable way employing only natural and organic ingredients. Kohl, or kajal, in use since the Bronze Age, is a traditional Egyptian cosmetic used to darken eyelids and eyelashes. It is still used in parts of the Arabic world and Asia (1). The traditional recipe of kohl contains galena, i.e. lead sulphide in its mineral form found in nature. Similarly, Claudius Galenus (2nd Century A.D.), the famous Roman physician, described how Romans used a mixture of lead oxide and slaked lime (calcium hydroxide) to dye hair black (2). Today both these cosmetic preparations are known to represent a serious threat for health. These are obviously extreme examples, but on the other side, caution should be used when speaking about *natural* ingredients. *Natural* is not a synonym of safe. In fact, *natural* ingredients according to European Regulations must undergo the same rigorous safety assessment as all other ingredients.
When speaking about sustainability we must consider that we are in front of a "cradle-to-grave" concept. To declare that a product or process is really a *sustainable* one, all steps of its production cycle have to be taken into consideration from several different points of view. In fact, all factors having an impact on the environment, producing waste and associated with a consumption of non renewable energy must be carefully evaluated. It is not sufficient at all that an ingredient is extracted from a natural source to consider it as a *sustainable* product. Several of these ingredients are extracted from huge amounts of starting raw materials, employing energy consuming purification procedures and sometimes with potentially dangerous solvents. As an example, to obtain one litre of rose oil three thousand kilograms of rose petals must be distilled. *Natural, organic* and *green* products can only be considered as *sustainable* if their use causes a real overall reduction of the impact on the environment, of the energy consumption and of the use of solvents or other potentially dangerous chemicals with regard to their synthetic counterparts.

### THE SURVEY

In order to address these questions and issues we decided to consult the members of our International Scientific Advisory Board and ask them the following simple question: "How do you define a *natural* ingredient?"
The replies of the Members of the International Scientific Advisory Board provided an interesting overview on the concept of *natural ingredient* as seen from different viewpoints. To make a broad classification, replies can be subdivided into four main classes. The first class of replies consists of technical definitions of the concept of *natural*, *organic* and *green*. The second class of replies analyzes the concept of *natural ingredient* from the functional point of view in terms of efficacy and consumer safety. The third class of replies deals with the concept of sustainability. The fourth class of comments deals with the use and abuse of the claims *natural*, *organic* and *green*. Several comments fall within more than one of these classes.

### WHAT IS A NATURAL INGREDIENT?

Several Members of the Board define a *natural ingredient* as *an ingredient that has been derived from a source, which as such is found in nature or has undergone a natural process mediated by microorganisms like fermentation*. Moreover, natural ingredients should be isolated exclusively using physical methods, like chromatography, distillation or supercritical fluid based extraction methods, and using non-toxic means or solvents like water or liquid nitrogen. If we speak about organic ingredients most comments obviously point out that *natural* doesn't necessarily

mean *organic*, but also that increasingly people are looking to products where *natural* is coupled to the *organic*. The criteria to identify a *green* product were summarized by one Member of the Board in five points which are basing on the more general *Twelve Principles of Green Chemistry* identified by P.T. Anastas (3):

- Use of organic practices to grow plants or care for animals: no or low pesticide/herbicide in cultivations, no antibiotics in farming.
- Manufacturing processes that minimize waste and leave the smallest footprint.
- R&D with the least environmental impact, e.g., using analytical techniques that minimize solvent use.
- Water management practices including water re-use, careful analysis of process effluent streams.
- Packaging the final product using recyclable material, degradable material, high post-consumer content".

With regard to extraction and processing procedures, a Member of the Board posed the question: "How much processing can a natural undergo and still be considered natural?" Another Member pointed out that: "Most natural ingredients have to be chemically modified to produce a molecule with the desired effect". One reply to these two crucial points is given by a third Member of the board who told us that: "Any other treatment which results in a chemical reaction or change will *destroy* the term *natural*. Such products may be named *from natural sources* or similarly".

**ARE NATURAL INGREDIENTS EFFECTIVE AND SAFER?**

Things become more complicated if we look at the functional aspects of natural ingredients, i.e. their efficacy, stability and safety. Members of the International Scientific Advisory Board pointed out several different focal points which should be addressed when dealing with the functional aspects of natural ingredients: toxicological assessment, cross reactivity between natural ingredients, allergenicity and irritation, dosage and real efficacy of active ingredients and preservation of the activity throughout ingredient processing and product formulation. As a first consideration we must think that plant extracts usually contain an average of 300 or so compounds and that only few of these compounds have been identified and studied. Even if toxicological and allergenicity data are available, adverse cross reactivity effects cannot be excluded when two or more natural extracts are joined in one formulation. Moreover, several natural ingredients can induce allergic reactions or irritant contact dermatitis in sensitive people. An important issue!

When speaking about the efficacy of natural ingredients (but also of synthetic ones) it must be taken into consideration that many active compounds are easily inactivated by light, oxygen or moisture. Extraction procedures, preservation of extracts, the reconstruction and the addition to formulations and the preservation of finished products are therefore critical points. To this regard it must be underlined that, as for conventional ingredients, no guidelines for natural ingredient efficacy testing in finished formulations exist. Moreover, the concentration of active natural ingredients may be too low in the final product to have any effect. To make a long story short, too many natural ingredients exist on the market and too little is still known about their effects and toxicology to have a clear idea of their real advantages and their efficacy. In addition to that, the rapidly changing market makes it happen that popular ingredients are constantly mutating. In this context it is very difficult to make an assessment of the real efficacy of natural ingredients, of their advantages or disadvantages.

There is the need for a more systematic and scientifically sound approach to collect comparable data on the real efficacy, stability and safety of ingredients of natural origin. Finally, in this frame, we also have to distinguish between single molecules for which an already characterised synthetic "counterpart" may exist, novel molecules and complex plant extracts containing several hundreds of compounds.

**IS *NATURAL* REALLY SUSTAINABLE?**

The next point covered by the comments of the Members of the International Scientific Advisory Board deals with the concept of sustainability of natural ingredients. Several members of the board pointed out that there is a need for real sustainability within the context of natural ingredients production. As already told, when speaking about sustainability we must consider all aspects related to the production and the life cycle of a natural ingredient and not only its natural origin. A Member of the Board said: "not all natural ingredients are produced in a sustainable way. An ingredient may be of natural origin, but how does it perform? Is it cost-effective compared to synthetic alternatives? Poorer performance can result in greater usage and therefore also in greater amounts of waste!". One striking example of negative impact is given by the production of palm oil. Palm oil is a perfectly natural ingredient but the rapid expansion of oil palm plantations at the expense of natural forests across Southeast Asia represents a huge threat to tropical biodiversity. To this regard, it is worth underlining that local authorities, organisations and NGOs are trying to solve this issue within the context of the *Round Table of Sustainable Palm Oil (RSPO)*. To conclude this section, it is worth citing another Member of the Board who declared that:" A naturally derived ingredient which cannot be produced and used sustainably is worthless".

**USES AND ABUSES: THE NATURAL CLAIM**

Last but not least several Members of the Board extensively discussed the use and abuse of the claims *natural*, *organic* and *green* in the commercial practice and more general in the media, which reinforces the already distorted consumers' perception on these concepts. A first Member of the Board pointed out that: "The *natural*, *green*, *organic*, *sustainable* and similar concepts so broadly used - and misused - in personal care are the result, on one hand, of misconception by the end-users, and on the other, of manipulation - not always based on ethical principles", he also deplores the fact that: "there is no EU regulation on the matter, so the *natural* certification is left to private, profit-making organisations, each one using its standards for certification and sometimes sponsored by commercial producers". Finally he concludes that: "I can only consider *natural*, *green*, *organic*, *sustainable* fashion as an empty concept, fuelled by consumer ignorance and by the manipulation for commercial purposes". An extremely hard criticism!
Another Member of the International Scientific Advisory Board was also extremely clear telling us that: "We should not fall into the trap to set nature in contrast with chemistry", and that: "I think we should all fight the battle, against this trend of misinformation, fight at all levels, with and within the media, within our ads, with marketing, with the schools and universities, not only for the good of our industry, but for science in general, and for the good and wellbeing of the consumer. We have to contribute to better information, education of the general public!". Moreover, he added "What should count in the end for the consumer, and for supervising authorities, is not the origin of ingredients, or the products manufactured with these ingredients, but their inherent toxicity (or absence thereof) which only depends on their molecular structure" and concluded: "We need to invent processes, technologies, substances that integrate safety and environmental aspects from the start".

**CONCLUSION**

It is clear that this survey is offering only a very general overview of the topic. Entire books could be written on what *naturals* are and imply. We would like to consider the present article as a starting point for a more general discussion.
In any case, what is the take-home message of this survey? It is not easy to define *how and what* a *natural*, *organic* or *green* ingredient should be, and even more troubles arise if we investigate aspects like the efficacy, the safety or the sustainability of a *natural* product. This survey is dealing with the concept of *natural*, but at this point it must be underlined that most of these considerations are also true for the whole world of cosmetic ingredients. Several criticisms have been raised by the Members of the International Scientific Advisory Board of our journal on how natural ingredients are assessed and marketed today. Nevertheless, the apparent predominance of *negative* comments in this survey on *naturals* should not be considered as an opposition to these ingredients but rather should be seen as an invitation to a more rigorous approach to them – as for all products of the branch. What becomes clear from this survey is that there is a huge need for a more sober, scientifically sound and in some way even more transparent approach to natural ingredients and its marketing. Although great improvements in this direction are already underway, additional actions should be taken by experts, companies, media and governmental institutions in order to provide consumers with a more correct and scientifically sound information on the real benefits (if any) and weaknesses of *natural* ingredients with respect to their synthetic counterparts. Finally, a stronger effort against misleading or false claims should be implemented. The credibility of the *natural ingredients* sector is at risk. A study on *green claims* in Northern America released in 2009 by the environmental marketing consulting company *TerraChoice Environmental Marketing Inc*. (4) revealed that 98 percent of the products analysed committed at least one of the "seven sins of GreenWashing" they identified in hidden trade off, no proof, vagueness, worshipping false labels, irrelevance, environmental claims about product categories that are itself lacking in environmental benefits and totally false claims.

**REFERENCES AND NOTES**


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