Phytogenics users guide:

How to assess plant extracts based products in 5 steps with the FITEK® method?

The evolutions of the worldwide regulatory frameworks pushing for the global reduction of the use of antimicrobial substance in animal nutrition have highlighted the interest for phytomolecules and by consequence, have also increased the amount of available information to users. Phytomolecules benefits are described everywhere in the media and any providers has its own and distinct vocabulary to explain their advantages. Some manufacturers talk about "the effects of essential oils", some others "of the benefits of phytogenics", or "the use of plant extracts". As a final user of these additives (feed manufacturers, premixers, integrators…), how to differentiate products between them and how to assess their quality x efficacy?

The following article provides a brand new method and a user-friendly guide organized in a 5 steps- process to evaluate phytomolecules based products. This method (a.k.a FITEK*) intends to help final users to understand the phytomolecules market worldwide. It details all key questions a phytogenic user MUST wonder and why not, ask them to its provider!

*FITEK stands for F : formula, I : investment, T : technology, E : experience and K : knowledge

1: F stands for Formula: "As a final user, I want to know the exact formula & my guarantees!"

To know the clear & complete product formula is probably the key aspect for a good additive evaluation. The formula information relies on the provider declaration and can normally be found on legal documents such as labels & Material safety datasheet (MSDS)*. Very few companies also guarantee the minimum content in active ingredients through their certificate of analysis. This composition is the starting point to check the compliance of the product with local regulations.

a) Asking for composition: Which ingredients constitute the additive?

All ingredients contained in the product should be declared to the user. Any active molecule should be referenced with a clear designation of its origin (is it an essential oil, an extract, a tincture, an oleoresin, a synthetic molecule?) permitting to check the validity for its use in the given country where is operating the user.

Caution: It is frequent to meet suppliers declaring partial compositions.

b) Understanding the nature of the actives: Are the ingredients nature-identical of 100% natural?

Important market confusion exists between these 2 categories. Nature-identical ingredients are frequently used and most of the time allowed by regulation, as active ingredient. Their use in formulation can provide a better availability than the natural source, a higher purity in active thanks to standardization technics and can support the sustainability of its natural source. The use of these nature identical molecules should be explained and justified to the user.

From the fully natural side of the set of available ingredients, following main categories exist. They are classified hereafter from the less standardized to the most standardized categories:

- **Dried herbs (e.g: garlic, cinnamon powder…):** Their use is still quite important in Asia where human traditional medicine practices are still very used in animal nutrition. They consist in the use of dried & then grinded part of the plants. Their use in final feed requires important amount (> 1 kg /ton) to get the minimum quantity of active molecules. By consequence, their inclusion cost is not negligible. Also because of natural variation in plant composition (climate, harvesting conditions…) the daily intake of animals in active ingredient remains unknown and difficult to assess.

- **Essential Oils (e.g: oregano, eucalyptus essential oils…)** are mainly obtained by extraction through water distillation, often using steam. This process of extraction is not selective and it extracts all the light and volatile active molecules. The final composition of essential oil is also variable and its quality heavily depends on the place where the plant was grown. On the feed market, few essential oils are really fully standardized, this quality being mainly acceptable in term of price rather for human neutraceutical industries.

Using different extraction methods on a same plant can result in different active molecules selection. E.g: turmeric essential oil will mainly contain alpha- turmerone molecule when turmeric oleoresin will mainly contain curcuminoids.

- **Oleoresins (e.g: chili pepper, turmeric oleoresins…)** - are obtained by a selective process of extraction using a set of different solvents. These solvent are chosen depending on their affinity with the targeted active ingredient. Different levels of standardization are then available to formulators. As example, red chili pepper can be extracted to obtain a Capsicum oleoresin, which one can contain from 1 to 7% of capsaicinoids active ingredient.

Table 1 : Difference between main categories of raw materials.

	Variability	Concentration	Standardization	Dose in feed
Dried herb	high	low	None	> 500 g/t
Essential Oil	medium	Low to medium	None to partial	100 ppm
Oleoresin	low	Medium to high	Optimal	10 – 50 ppm
Nature identical	low	high	Optimal	1 to 20 ppm

c) Requiring clear guarantees on active ingredient to the provider

Once the clear composition is known from the supplier, asking for minimum content in active ingredient is a must! This type of information could be then communicated on the certificate of analysis. It ensures to the final user that any batch of a same product will be identical in time and that final field results obtained will be consistent with what was observed during experimental trial run on animals.

2: I stands for Investment: "as a final user, I want to know my ROI and I want it consistent on the field!"

The use of an additive based on phytomolecules has two main objectives. The first and most common is to improve users benefits (promoting growth, reducing veterinary treatments…) and the second to help formulators in replacing chemical molecules (intended to be forbidden such as antibiotics growth promoters). These 2 strategies are quite different and their validation will most of the time rely on experimental trials. The zootechnical results obtained will help to calculate a return on investment for the user. Various experience showed that repeating the same trial several time might be important to really conclude on the efficacy of an additive.

The cost of inclusion, and by consequence the recommended dose of the additive, are parameters directly influencing ROI. Therefore, the most concentrated version of an additive will necessarily increase benefits, reducing its inclusion cost. Finally, it is highly recommended to the user to check the conformity of the recommended dose by the supplier with the one approved in scientific publications related to efficacy of the product. It is very frequent to meet with providers recommending lower dose than the one approved by scientific community, in order to reduced inclusion costs. This could dramatically affect performance!

3: T stands for Technology: "as a final user, I want the additive to be stable and resistant!"

Phytomolecules can be formulated following different types of manufacturing process. The most observed is the absorption of liquid raw materials on absorbing carrier such as silica. The mixture can be then diluted with Calcium carbonate, salts or sugar. The main disadvantage of this is the lack of protection of the ingredient and the high losses in active ingredient in time or during feed manufacturing process (see figure 2). This is why, nowadays, more and more suppliers now invest in encapsulation technologies. These elaborated processes are more costly and aim to protect the actives in a matrix, which will then be optimally digested by animals. Among them, 3 major processes are now commonly known:

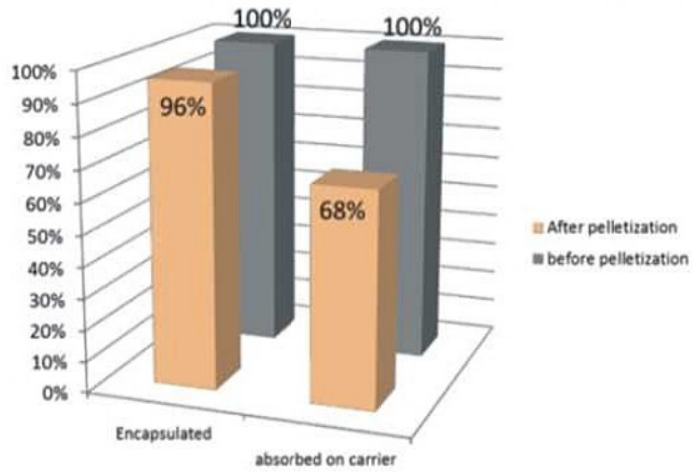
- Spray cooling: This technology uses the difference of temperature between a solution of warm liquid oil preparation (containing the active molecule) and the cool air temperature in the spraying tower. This gradient of temperature ensures that the sprayed droplets of oil will solidify while binding actives in its core.

The advantage of this process is the use of the cool air which is not stressful for active ingredient.

- Spray dry: This technology consists in spraying a liquid solution (containing the active molecule) into a warm ambient spraying tower. Any droplets of solution will evaporate its own water content and immediately solidify, binding the active molecules in. This technology is as example highly appreciated to provide soluble solutions to be applied in water system and milk replacer, void of oily matrix.

- Coating: Different type of processes can lead to coating of molecules. It mainly consists in applying an/several external protective surface to the particle. A coating can be simple or with multiple-layers.

Figure 2: Effect of the technology on recovery of active ingredient: Recovery of carvacrol molecule (used as tracer) in mash feed prior to pelletization and pellets after pelletization (80°C).



Finally the type of technology will define the product physical appearance (particle size, color, smell etc..) which will be critical for additive handling. Premix or feed homogeneity tests could be run in collaboration with the supplier in order to check the full compatibility with the media.

4: E stands for Experience: "as a final user, I want a provider with deep experience!"

The recent raise of interest for plant extract based product as clearly opened the market to new actors. Many companies historically focusing on different types of additives are now trying to establish on this segment. Usually coming from different business models, these companies may struggle to answer the requirements of this business and are often temped to simply extend their raw material portfolio to the plant extracts, without modifying their research strategy or quality control procedures.

In countries of the European commission, there is a standard of reference which can help to assess which providers are fully competent on this segment. In fact, EFSA is regularly evaluating additives based on plant extracts in the aim of upgrading them from sensorial to zootechnical category. This evaluation being very complete (from production of the raw materials, to safety and performance) the final opinion released by EFSA experts is generally really interesting. All the reports are public and available online.

Finally, the leading companies of this segment are also easily identifiable thanks to their active participation to FEFANA or to the European consortium (FFAC) actually studying at the future of botanical in Europe.

5: K stands for Knowledge: "as a final user, I want the provider to understand its product mode of action!"

The first plant extract based products were launched in the 90's in Europe. At this moment, antibiotics growth promoters were still allowed but their ban was starting to appear as a reality. In that context, most of the products were first developed to replace AGPs, it was their primary objective. Research programs around plant extracts therefore looked first at their antimicrobial effect. Most of the studies were made in-vitro and using dose of extracts far above the reality in feed (see table 2). During decades, the industry believed in this mode of action and focused on this application. Later and when research technologies evolves, the market understood that the real effect of AGPs in animals were not well defined. Controversial publications (Niewold, 2006) started to talk about the potential anti-inflammatory effect of AGPs and opened new research pipeline for plant extracts development.

Nowadays, some providers of plant extract products are dedicating their research to the clear understanding of the plant extract mode of action, beyond any antimicrobial effects achieved with unrealistic high dose. A new wave now consists in clearly identifying the gut receptors that plant extract may trigger, as well as the cascade of metabolic changes induced by this action. It opens huge opportunity for animal feed as well as for human medicine.

Table 2: Phytomolecules concentration in feed is at least 10 times inferior to related MIC50. Pei et al., 2009; K.-W. Lee, H. Everts and A.C. Beynen, 2004

Phyto-molecule	Gram - MIC *E. Coli* (ppm)	Gram + MIC *Strepto. M (ppm)*
Eugenol	1 600	-
Thymol	225 - 400	250
Carvacrol	225 – 400	125

√s

Additives @ feed inclusion (ppm) level
6 – 10
5 – 10*

Conclusion

Despite the huge amount of available information on phytomolecules, it is possible for their users to evaluate the different available additives on the market. This evaluation should be objective and repeatable. The FITEK method described in this article provides a standard grid for a complete assessment. Providers of phytomolecules remain the first allies to answer the questions raised by the user. Beyond additive performance, a wide set of information should be provided and guaranteed in order the performance levels observed during the evaluation are consistent when using the additive in field conditions. It is time for transparency!

Want to learn more? Contact our expert

Jennifer Maurin
Business development manager for bioactives
(XTRACT® and Nex)
E-mail: jennifer.maurin@pancosma.ch
Tel: +41 22 929 84 52 | Mob: +41 79 915 6930
Web: www.pancosma.com

Pancosma is a global pioneer in developing, manufacturing and distributing a wide range of innovative feed additives. With more than 70 years of experience and real know-how, the company based in Geneva, Switzerland, is present in 75 countries worldwide.

For more information please contact:

Nurture Organics Pvt. Ltd.
53/41, Ramjas Road, Karol Bagh, New Delhi-110005
Tel. : +91 11 28722053, 45614322 Fax : +91 11 28725697
E-mail : admin@nurtureorganics.net Web : www.nurtureorganics.net