

Quality management of *Moringa oleifera* for the food industry in Europe

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Abstract

The development of a quality management system for *Moringa oleifera* leaf powder to be used as a food-ingredient in Europe is outlined. A quality management system should be based on the principles of hazard analysis and critical control points (HACCP). Contaminants and food hygiene requirements are briefly described and examples of the most relevant food laws in Europe and Switzerland are given. Based on these, a testing plan can be developed and necessary documentation provided to assure the customers of the quality of the produce. Needs regarding production-processes such as using lot-numbers and ensuring traceability are presented. To establish moringa as the highly valuable food-ingredient that it is, food-safety has to be ensured.

Keywords: *Moringa oleifera*, quality management, microbiology, pesticides, contaminants

INTRODUCTION

In this article, an analysis of food safety management for *Moringa oleifera* leaf powder (MLP) is outlined. Only an overview is given as this article is based on a short oral presentation given at the First International Symposium on Moringa in Manila, Philippines, November 2015.

MLP is the most common *Moringa oleifera* product in Europe being a versatile ingredient in a wide range of recipes. For use by established food producers, adequate quality management has to be developed. This is based on the principles of hazard analysis and critical control points (HACCP) as required by industry standards, for example ISO 22000:2005, and by government food inspectorates.

DISCUSSION

HACCP analysis

According to FAO/WHO (2016), HACCP is a process to systematically analyse the factors influencing the quality of a food and to determine means to ensure food safety. In a dossier, all relevant information on the product is compiled and evaluated in respect to product safety. From the analysis, critical parameters are identified and means to control them are laid down.

As defined by the FAO/WHO, an HACCP-System consists of seven steps:

1. Conduct a hazard analysis.
2. Determine the Critical Control Points (CCPs).
3. Establish critical limit(s).
4. Establish a system to monitor control of the CCP.
5. Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.
6. Establish procedures for verification to confirm that the HACCP system is working effectively.
7. Establish documentation concerning all procedures and records appropriate to these principles and their application.

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In the course of working through the HACCP-steps, all necessary documents are created that help to understand product safety and that will also be used to document the quality of the product for the clients. In the following, some aspects of this process are discussed.

Identification of consumer groups

To understand the necessary quality of the product, consumer groups who use MLP need to be identified. From the health status of consumers a required safety level is derived that needs to be met by the product. For MLP, healthy adults, children and elderly are the relevant consumer groups, though also susceptible populations may consume the product.

Identification of uses

Requirements of product quality are influenced by the uses of a product. The consumed quantity and the way a food is prepared will determine the level of food safety needed and which requirements of food laws apply.

MLP can be used directly in cold applications such as smoothies or salad dressings that lead to a consumption without heating, or it is used as tea or in vegetable-stews, where microbiological safety of the product is higher due to the heating process. MLP is used in recipes at larger quantities than spices, requiring better microbiological quality than the latter.

Analysis of the production process and product

To establish possible risks involved with a product, the production process needs to be known: how is moringa grown? Which agricultural practices are used? How is it harvested and processed? The production process can be visualised in a flow diagram showing the movement of material and technologies used, including critical process parameters like drying temperatures. It is also necessary to know general properties of the product, such as physical properties, composition, moisture content or granulometry. This information is necessary for the risk analysis and to compile a product specification later on.

Legal framework – novel food

In Europe, with a relatively new and unknown food like MLP, it has to be determined whether it falls under the requirement of the novel food legislation as laid down in Regulation (EC) No 258/97 (European Parliament and the Council of the European Union, 1997). A novel food is food that has not been consumed to any significant degree in the EU before May 1997. In the EU, *Moringa oleifera* products from leaves and pods are not considered a novel food since spring 2014 and thus can be brought on the market as food. As Switzerland is not part of the EU, it had to be established that Swiss food safety authorities also accept MLP as food.

Legal framework – contaminants and food hygiene

For Vitarbo, intending to market moringa in Switzerland and Europe, both legislations need to be observed. Generally, Swiss food law is designed to comply with most European requirements so that there are few differences. Beyond that, individual European countries may have specific legislation that has to be checked. In the following, only the most important legislation is given that covers microbiological criteria, pesticides and other contaminants such as heavy-metals.

Food legislation in Switzerland:

- Swiss Federal Act on Foodstuffs and Utility Articles (LMG) (Bundesrat Schweizerische Eidgenossenschaft, 2005).
- Swiss Ordinance on Foreign Substances and Ingredients in Food Products (FIV) (Bundesrat Schweizerische Eidgenossenschaft, 2015).
- Swiss Ordinance on Food-Hygiene (HyV) (Bundesrat Schweizerische Eidgenossenschaft, 2014).

Examples of European food-safety legislation:

- Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs (EUR-Lex, 2006).
- Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin (European Parliament and the Council of the European Union, 2008).

Establishing existing food safety issues

For a risk analysis it is important to know, which problems have occurred with a particular product in the past. In conversations with suppliers, producers and other involved parties, concerns of food safety can be gathered and are included in the analysis. Over time, as our own chemical and microbiological analyses became available, new food safety requirements were recognised and were included in the analysis.

Another source is the European database “Rapid Alert System for Food and Feed (RASFF)” (European Commission – Food, 2016) that lists all official safety issues that have been reported for a food. Searching this database on “Moringa”, seven reports are listed for the time between 2010 and November 2015 (Table 1). Salmonella infections were notified five times, an insecticide was found in moringa fruit/pods, once, and the heavy metal lead was detected in amounts above permitted levels, once.

Table 1. RASFF-notifications on “Moringa”.

Date	Country	Reported issue
19.11.2010	Germany	Unauthorised substance [insecticide] monocrotophos (1.02 mg kg ⁻¹) in drumstick (<i>Moringa pterygosperma</i> [synonymous name for <i>M. oleifera</i>]) from India
26.09.2012	Germany	<i>Salmonella bredeney</i> and <i>Salmonella llexington</i> in moringa powder from India
27.03.2014	Germany	<i>Salmonella</i> spp. (presence 25 g ⁻¹) in food supplement – moringa powder from Germany
01.04.2014	Germany	<i>Salmonella infantis</i> (presence 25 g ⁻¹) in food supplement – moringa powder from Germany
25.07.2014	Germany	Heavy metal lead (92.8 mg kg ⁻¹ - ppm) in <i>Moringa oleifera</i> food supplement from Germany
06.03.2015	Austria	<i>Salmonella</i> spp. (presence 50 g ⁻¹) in moringa leaves powder from India
13.10.2015	Germany	<i>Salmonella</i> (presence 25 g ⁻¹) in organic moringa leaf in powder and capsules from India

To keep the risk analysis effective, it has to be updated continuously, as new information becomes available.

Traceability

Food producers are required by law to be able to give information on the origin and the distribution of their product. Every participant in the chain from farm to fork has to be able to document the link one step before and one step after their own activities. This way, in case of an issue with a food, the source of a problem and affected parties can be identified. In Switzerland, this legal requirement is laid down in the Swiss Food and Commodities Regulation (Art. 49 No 3 c). To enable traceability, food producers must keep records of movements of their products: how much was bought, processed and sold. Basis for traceability is a production lot, this is a quantity of food produced under the same conditions (e.g., same field, harvest, processing) and is considered homogenous regarding its quality. For records to be maintained, individual productions have to be labelled by lot numbers. Using lot numbers, any product can later be identified and linked to other records such as production reports or analyses made. Lot numbers are easily created by the company itself in a way it believes fits best. Lot numbers have to be unique and can give some information on the product, for example when or where a product was produced. All products sold to food producers have to be labelled with lot numbers.

Sampling

The foundation for good food quality are reliable chemical and microbiological analyses. Reliable analyses are dependent on good, representative sampling. Products like MLP have a high risk of inhomogeneous distribution of microorganisms. To obtain meaningful samples, the product should be thoroughly mixed before sampling and then sampled in several places. The subsamples are then mixed to give one representative sample. For sampling, detailed technical standards exist such as ISO/TS 17728:2015 (sampling techniques for microbiological analyses of food and feed samples). Following the principles of these standards will provide reliable analyses.

Quality criteria

For chemical contaminants like heavy metals, pesticides or polycyclic hydrocarbons, there are detailed legal requirements set down in the legislation given above. For pesticides, an extensive European database can be accessed online, giving maximum residue levels (MRL) for listed pesticides and foods. (European Commission – Plants, 2016). Regarding MLP, it has to be decided, under which category of food MLP is falling: is moringa a herb, a tea, or does it belong to leafy vegetables. Frequently, MRL are different for each category. For most foods, fresh products, and not dried powders as is the case of MLP, are the basis for the MRL. In this case, the analytical result obtained on dried moringa has to be calculated back to fresh moringa leaves.

As it becomes clear by the analysis of existing food safety issues, microbiological quality is an important topic. To set up microbiological criteria for MLP, several sources can be used:

- Swiss and European food laws as listed above.
- Other official requirements, for example by Pharmacopoeias for herbal teas.
- Industry standards like the THIE-microbiology standard for herbal teas (Tea & Herbal Infusions Europe (THIE), 2016).
- Requirements coming from customers.

Based on an analysis of these resources, the number of criteria that are relevant, as well as levels to maintain, can be established.

Establishing and implementing a testing-plan

After completing the risk-analysis for MLP, a testing plan is compiled, listing analyses, acceptable limits and frequencies of analyses according to the risks that have been established (Table 2). Not all analyses need to be performed locally by a producer, and in some countries suitable laboratories may be absent. This is especially relevant for pesticide-residues that are expensive, require low limits of quantification and need to cover many substances. In these cases, the burden can be shared between producers and customers. On the other hand, some analyses can easily be performed locally or even in an internal quality control.

Table 2. Examples of elements of a testing plan for MLP (conditions depend on local situation).

Parameters	Laboratory	Frequency
Moisture	Internal	Every production
Sensory analysis / foreign bodies	Internal	Every production
Nutrients	External	Once a year
Pesticides	External	Every shipment? Once a year? As customers require?
Heavy metals	External	Once a year
Microbiology	External	Every production
Proteins	External	As customer requires

The frequency with which individual parameters are tested depends for example on the risk involved, the production technology or how frequently customers need specific analyses for their products.

When a testing plan has been compiled and the analyses have been performed, a certificate of analysis (COA) can be written for each lot, providing documentation of the quality of the product for the customers.

Documentation derived from quality management

A HACCP-based quality management system provides reliable information on the product and this information can be used to assure customers of the quality and safety of the product.

Quality criteria are included in the product specification, a document that specifies the guaranteed quality of the product and contains information on food safety and food composition to enable customers to include MLP in their recipes.

Technical data sheets and marketing documents provide additional information on detailed nutrient composition or on guides for application of a product.

A COA lists analytical results for relevant parameters of a specific lot of a product. Not all parameters given on a specification are tested in every certificate of analysis. Which information needs to be given on a COA can be agreed upon individually with every customer.

CONCLUSIONS

Establishing a quality management system is a legal obligation to market MLP in Europe and it is demanded by customers as well. Maintaining a good quality management system is an on-going process. Some work can be done by companies in Europe, but certain prerequisites are necessary to be provided by producers, such as representative sampling and clear traceability by using lot numbers. Providing and assuring product safety, obviously is an important quality criteria for consumers, but also for individual companies and for all moringa producers together, as quality problems on the market will discredit the product as a whole. As the market matures and more is known about the product, there will be an ongoing improvement of quality standards, resulting in an increased recognition of the product.

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Literature cited

Eidgenossenschaft, B.S. (2005). Swiss Federal Act on Foodstuffs and Utility Articles (LMG). <https://www.admin.ch/opc/de/classified-compilation/20050153/index.html>.

Eidgenossenschaft, B.S. (2014). Swiss Ordinance on Food-Hygiene (HyV). <https://www.admin.ch/opc/de/classified-compilation/20050160/index.html>.

Eidgenossenschaft, B.S. (2015). Swiss Ordinance on Foreign Substances and Ingredients in Food Products (FIV). <https://www.admin.ch/opc/de/classified-compilation/19950193/index.html>.

EUR-Lex. (2006). Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs. <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1450268102959&uri=CELEX:02006R1881-20150731>.

European Commission – Food. (2016). RASFF portal. http://ec.europa.eu/food/safety/rasff/portal/index_en.htm.

European Commission – Plants. (2016). EU-pesticides database. http://ec.europa.eu/sanco_pesticides/.

European Parliament and the Council of the European Union. (1997). Regulation (EC) No 258/97 of the European Parliament and of the Council of 27 January 1997 concerning novel foods and novel food ingredients. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1997R0258:20090120:en:PDF>.

European Parliament and the Council of the European Union. (2008). Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin.



<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2005R0396:20080410:EN:PDF> FAO/WHO. (2016). General principles of food hygiene FAO/WHO codex alimentarius, CAC/RCP 1-1969 Rev. 4-2003 www.codexalimentarius.org/input/download/.../CXP_001e.pdf.

Tea & Herbal Infusions Europe (THIE). (2016). THIE's recommended microbiological specifications. <http://www.thie-online.eu/about-thie/publications/>.