



QUALITY MANAGEMENT GUIDE FOR THE OLIVE-POMACE OIL EXTRACTION INDUSTRY

1. Scope

This guide is for businesses, irrespective of their size or legal status, that extract crude olive-pomace oil from the pomace obtained in mills after producing virgin olive oil. It provides pertinent advice on quality management from the time the raw material enters the extraction plant until the crude olive-pomace oil and depleted pomace are obtained.

2. Purpose

This guide specifies the rules that have to be followed at the extraction plant as regards hygiene, hazard identification and quality assurance in order to ensure the obtention of crude olive-pomace oil and depleted pomace that meet commercial standards.

3. Definitions

Food hygiene – All the conditions and measures necessary to ensure the safety and suitability of food at all stages of processing.

Good hygiene practice – All the rules recommended to businesses concerning the conditions and measures necessary to ensure the safety and suitability of food at all stages of processing.

Good manufacturing practice – All the rules recommended to businesses concerning the measures necessary to ensure the safety and suitability of food at all stages of processing.

Cleaning – The removal of soil, food residues, dirt, grease or other objectionable matter.

Contaminant – Any biological or chemical agent, foreign matter or other substances not intentionally added to food which may compromise food safety or suitability.

Contamination – The introduction or occurrence of a contaminant in food or a food environment.

Disinfection – The reduction, by means of chemical agents and/or physical methods, of the number of microorganisms in the environment, to a level that does not compromise food safety or suitability.

Hazard – A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

Risk – A function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food.

Control measure – Any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

HACCP – A system which identifies, evaluates and controls hazards which are significant for food safety.

Hazard analysis – The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and therefore should be addressed in the HACCP plan.

HACCP plan – A document prepared in accordance with the principles of HACCP to ensure control of hazards which are significant for food safety in the segment of the food chain under consideration.

Critical control point (CCP) – A step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

Critical limit – A criterion which separates acceptability from unacceptability.

Control (verb) – To take all necessary actions to ensure and maintain compliance with criteria established in the HACCP plan.

Control (noun) – The state wherein correct procedures are being followed and criteria are being met.

Corrective action – Any action to be taken when the results of monitoring at the CCP indicate a loss of control.

Quality – The totality of characteristics of an entity (which can be individually described and considered – product, process, business) that bear on its ability to satisfy stated and implied needs.

Quality system – The organisational structure, procedures, processes and resources needed to implement quality management.

Quality assurance – All the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfil requirements for quality.

Quality control – The operational techniques and activities that are used to fulfil requirements for quality.

Quality management – All the activities that determine the quality policy, objectives and responsibilities, and that implement them by every means to ensure quality planning, control, assurance and improvement within the quality system.

Quality plan – A document setting out the specific quality practices, resources and sequence of activities relevant to a particular product, project or contract.

Traceability – The ability to trace the history, application or location of an entity by means of recorded identifications.

Audit – A systematic and functionally independent examination to determine whether activities and related results comply with planned objectives.

Certification – The procedure whereby official certification bodies and officially recognised bodies provide written or equivalent assurance that foods or food control systems conform to requirements. Certification of food may be, as appropriate, based on a range of inspection activities which may include continuous on-line inspection, auditing of quality assurance systems, and examination of finished products.

4. Definition of the products handled and obtained by the olive-pomace oil extraction industry

4.1 Products handled by the plant

The product handled by the olive-pomace oil extraction industry is the olive pomace left at the mill after producing virgin olive oil which is obtained from the fruit of the olive tree (*Olea europaea* L.) solely by mechanical or other physical means under conditions, particularly thermal conditions, that do not lead to deterioration of the oil.

Wet fatty pomace is made up of the flesh, skin, kernel and stone of olives and of a variable amount of vegetable water and oil depending on the method employed to produce the virgin olive oil, the quality of the olives processed at the mill and the mill equipment.

- Pomace obtained by pressing the olive mash: oil content of approximately 3–9% in the pomace as such and moisture content of approximately 25–35%;
- Pomace obtained by three-phase centrifugation of the olive mash: oil content of approximately 2.5–6% and moisture content of approximately 45–55%;
- Pomace obtained by two-phase centrifugation of the olive mash: oil content of approximately 2–3.5% and moisture content of approximately 60–70%.

4.2. Products obtained by the plant

The olive-pomace oil extraction industry produces:

- crude olive-pomace oil obtained by using authorised food-grade solvents to extract the oil from olive pomace which has previously been dried;
- depleted olive pomace, which is the dry olive cake left over after extracting the olive-pomace oil.

5. Description of the manufacturing processes in the extraction industry

Delivery of raw and auxiliary materials

- Olive pomace from pressing, three-phase centrifugation or two-phase centrifugation systems.
- Extraction solvent: hexane or other authorised food-grade solvents.

Storage of raw and auxiliary materials

. Wet fatty pomace:

- In sheds, open areas or ponds prepared in such a way as to avoid any environmental pollution by filtration and any contamination of the pomace.

Solvent:

- In separate tanks, kept apart from the drying facilities, preferably sunken, and complying with the general safety rules for inflammable products.

Drying of the pomace

- Operation carried out by blowing hot air over the pomace as it runs through a trommel in order to lower the moisture content to around 10%; the temperature of the pomace at the end of drying should not be more than 70–80 °C.

The object of drying is to halt the fermentation of the pomace and to enable extraction of a quality product.

Conditioning (in the event of storage)

- Cooling of the dried pomace by natural or forced ventilation to ensure it keeps properly.

Extraction

- Extraction, by means of hexane or other authorised food-grade solvents, of the oil contained in the dried fatty pomace in fixed batch extractors where the pomace is placed in an upright reactor and sprayed with the hexane, or in continuous extractors where it is washed with hexane.

Distillation

- Distillation of the oil-hexane mixture (miscella) in a batch and/or continuous distiller at a temperature of around 100–110 °C to try to remove the hexane from the oil as far as possible.
- Cooling of the oil.

Storage of resultant products

- Crude olive-pomace oil: in tanks, preferably made of stainless steel.
- Depleted pomace: in open-sided sheds or open-air areas prepared in such a way as to prevent contamination of the pomace and of the environment.

6. General principles for the installation of olive-pomace oil extraction plants and hygiene recommendations

6.1. Plant location

- Plants should preferably be located away from urban areas.
- Plants should preferably be located away from public watercourses and areas subject to flooding unless sufficient safeguards are provided.

6.2. Buildings and facilities

The basic installations of an extraction plant shall consist of the following:

- Areas for the storage of the fatty pomace and depleted pomace: such areas shall be clearly demarcated and prepared for each exclusive purpose and shall be located on solid, impermeable ground that should be slightly sloping in the case of outdoor yards to prevent rainwater from stagnating.
- Drying area: this includes drying lines and feed and discharge equipment. Drying facilities shall be located in sheds made of material that is very mechanically resistant and fireproof and shall be adequately ventilated and lit. Floors and walls shall be smooth and continuous. Such areas shall be completely separate from the extraction area.
- Extraction area: this includes the extraction, distillation, storage and hexane recovery facilities. The entire area where hexane is used shall be clearly demarcated and indicated and shall be separate from the other facilities, primarily from areas where there are sources of heat or fire. Fireproof materials of high mechanical resistance shall be used and the facilities shall be adequately ventilated and lit. Floors and walls shall be smooth and continuous and equipment and facilities shall comply with the existing legal regulations.
- Boiler room: the boiler room, housing the boiler(s) for producing the steam needed in the extraction process, shall comply with the existing legal requirements for such facilities.
- Warehouse: this comprises the facilities for the storage of the oil, both indoors (tanks, crates and troughs) and outdoors (aboveground tanks). It shall be equipped with sufficient pipes and pumps, which shall preferably be fixed.

- Other areas: any other process (separation, pellet formation, etc.) shall be carried out in specific facilities specially planned and designed for such purposes.
- The plant shall have fire safety facilities equipped with sufficient fire hydrants for all the areas where there is a fire risk.

6.3. Premises

- Walls and partitions should have a smooth surface made of impervious materials that are easy to clean and disinfect.
- Floors should be made of heavy-duty, impervious, non-slip material. They should be easy to clean and disinfect and should ensure good drainage.
- Windows should be fitted with screens to prevent the entry of insects and rodents, and they should be easy to clean.
- Doors should have smooth, non-absorbent surfaces and should be easy to clean and to disinfect. Outer doors should open outwards and be easy to open from the inside. They should be adequately close-fitting to prevent the entry of pests or any other small animals.
- Floor openings for lines or pipes should be adequately protected to prevent any contamination.
- Adequate space should be left between equipment to enable staff to move without risk.
- Ceilings should be at least three metres high.
- Each worker should have a minimum space of two square metres.
- Artificial lighting should be adapted to handling areas. Light bulbs should be protected to prevent contamination in the event of breakage.

6.4. Staff hygiene

- Changing rooms and toilet facilities shall be provided for all the staff in compliance with the relevant existing regulations.
- Staff shall be encouraged to apply good industrial hygiene practices.

- The premises shall be kept clean and tidy as a measure to prevent possible sources of infection or contamination.

6.5. Responsibilities – recording of inspections

The management of the business, or a person delegated for this purpose, shall be responsible for implementing and monitoring the application of the hygiene rules as well as of the rest of the technical and analytical parameters laid down to ensure plant efficiency and safety.

7. **Hazard identification, analysis and control**

7.1. Delivery of raw materials:

Hazards:

. Chemical: contamination of the wet fatty pomace by the transport vehicle, fermented pomace, oxidised pomace,

. Physical: presence of extraneous matter (e.g. pieces of glass, metal, wood and plastic).

Preventative measures:

. Visual inspection to check for the presence of extraneous matter.

. Recommended supply (or check) of the certificate issued by the mill supervisor stating the previous load carried by the vehicle. This should guarantee the quality of the goods or product and the compatibility of the previous load with olive-pomace oil.

Corrective action:

. Rejection of the consignment.

7. 2. Storage of the fatty pomace

Hazards:

. Accidental contamination due to the flow or seepage of dirty water.

. Pest attacks.

. Microbiological and mineral contamination.

Preventative measures:

- . Protection of the storage area from possible seepage or build-up.
- . Prior disinfection, protection of the area against pests.
- . Regular stock turn-over.

Corrective action:

- . Separation of the contaminated fatty pomace and allocation for other uses (fuel, ...).

7.3. Drying

Hazards:

- . Deterioration of the oil contained in the fatty pomace owing to excessively high drying temperatures.

Preventative measures:

- . Control of the temperature of the pomace at the end of drying; the maximum acceptable temperature is 70–80 °C.
- . Automated control of the temperature of the hot air at the furnace outlet and of the temperature of the fumes and steam at the trommel outlet according to the pomace feed rate into the trommel.
- . Obtention of good quality oil, particularly as regards the content of polycyclic aromatic hydrocarbons.

No limit can be fixed but procedures can be established to help attenuate the problem. Such procedures should be drawn up in each unit.

Control points:

- . Temperature: 70–80 °C.
- . Moisture content: as high as possible, around 8–10%.

Critical limits:

- . Temperature: 70–80 °C.
- . Moisture content: as high as possible, around 8–10%.

Control system for each CCP:

- . Moisture and temperature control.

Corrective action:

- . Review of operating parameters.
- . Control of physical levels.

7.4. Conditioning of dry pomace

Hazards:

- . Fermentation caused by inadequate or excessively slow cooling.
- . Self-combustion caused by excessive heat.

Preventative measures:

- . Regular mechanical stirring of the dried pomace to cool it uniformly.
- . Regular stock turn-over.

Critical limits:

- . Moisture content: around 10% (risk of self-combustion and fermentation at 20%).
- . Maximum temperature: 60 °C.

Control system for each CCP:

- . Regular moisture and temperature control.
- . Control of operations and recording of the verification of all the CCPs.

Corrective action:

- . Review of operating procedures.

7.5. Extraction

Hazards:

. Residual presence of hexane in the depleted pomace which might give rise to the risk of explosion or ignition.

Preventative measures:

. Control of the process of desolventising and desorption according to the type of extractor used.

. Revision of the facilities to ensure ventilation in order to avoid fires and explosions (suitable fire and explosion prevention scheme).

. Control of the vapour atmosphere at the pomace outlet by means of appropriate equipment.

Critical limits:

. Explosive hexane–air mixture.

Control system for each CCP:

. Proper ventilation of each area.

Corrective action:

. Continuation of extraction.
. Longer desolventising.

7.6. Distillation

Hazards:

. Residual hexane content in the oil of more than 200 ppm.

Preventative measures:

. Control of the temperature, pressure and vacuum according to the type of distillator used.

. Distillation temperature of not more than 100–110 °C.

Critical limits:

- . Oil temperature in final distillator: 100–110 °C.
- . Hexane in oil: 200 ppm.

Control system for each CCP:

- . Verification of correct installation conditions.
- . Regular control and recording of the hexane in the oil.
- . Control of the hexane in the depleted pomace.

Corrective action:

- . Adjustment of the technological operating parameters.
- . Re-distillation of the oil.

7.7. Storage of the products obtained

- Crude olive-pomace oil

No hazard is identified at this stage provided good manufacturing and hygiene practices are observed.

- Depleted pomace

Cooling and storage of the depleted pomace in optimal conditions in order to prevent compaction and self-combustion.

8. Control of quality records, quality audits

Process	Product	Control	Person/body responsible	Frequency
Delivery	Fatty pomace	Certificate of previous delivery load	Mill	Every delivery
	Hexane	Specifications	Supplier	Every delivery
Raw material storage	Fatty pomace	Record of cleaning, disinfection, area preparation, stock turnover	Plant	Weekly
	Hexane	Check of tank air-tightness, controls, piping, inspection log	Plant	Weekly
Drying	Fatty pomace	Record of furnace and pomace outlet vapour temperature Pomace feed record Moisture rate control	Plant	Continuous
			Laboratory	Daily
Conditioning	Airing of pomace	Control of pomace temperature Stock turnover	Plant	Daily
Extraction	Dried fatty pomace + hexane	Control of temperature hexane flow, pressure	Plant	Continuous
		Check of measurement instruments	Plant	Six-monthly
		Residual hexane content	Laboratory	Weekly
		Control of hexane recovery	Laboratory	Weekly
Distillation	Miscella	Control of temperature, pressure, hexane content of oil. Control of hexane-air mixture. Control of residual hexane content.	Plant	Continuous
			Laboratory	Daily
Storage	Crude olive-pomace oil	Record of tank, pump and pipe cleaning	Plant	Weekly
		Control of impurities content	Laboratory	Weekly
		Separation of stock for technical use	Plant	
	Depleted pomace	Storage area maintenance records Residual fat content	Plant Laboratory	Weekly Weekly

9. Training

The plant manager should ensure that all staff are aware and informed of the extent and nature of the risks connected with production. They should understand the operations for which they are responsible and should know how to perform them properly.

Staff training programmes shall be organised at regular intervals and adequate records shall be kept of training activities, including the full name and signature of participants.

10. Guidelines for drawing up the self-check plan

Each plant should appoint an officer in charge of managing the self-check system who will be assisted by a team of appropriately skilled staff in order to draw up the company plan of good hygiene practice.

The team will verify the self-check plan against the description of the processing plans according to the effectiveness and consistency of the procedures laid down in the handbook of good hygiene practice.

If any inconsistencies are observed, the necessary adjustments will be made.

Monitoring procedures should also be drawn up. Such procedures should specify the monitoring methodology and frequency at each risk stage and the check procedures in order to improve the production system and the product.

11. Management of unsuitable products

The procedures indicated in the table in section 8 shall be applied for managing unsuitable products at each stage of extraction.

Packed product withdrawn from the market on the grounds of unsuitability shall also be removed from the accounts. The oil shall undergo reprocessing at the specific points of the extraction cycle and it shall be managed according to the procedures specified in section 8.

12. Management of documentation

The documentation relating to the self-check system and staff training shall be filed and shall state:

- . events which are assessed as posing a real risk of contamination
- . measures taken to eliminate such risks
- . any changes in terms of new staff or in the production process.

13. Developments in the system

The points outlined above should be considered of general value as they refer to the universe of olive-pomace oil extraction businesses.

In specific operating and logistic situations, businesses may have to assign different risk weightings to those set out in this guide. It is the responsibility of the business to analyse the risk on the basis of the process implemented and of the experience acquired.

This guide is the end result of knowledge and experience to date. Hence, it will need to be updated periodically on the basis of bibliographical works and of the technical/scientific publications printed in the relevant literature.

14. References

CAC/RCP 1-1969, Rev. 3 (1997) Recommended international code of practice – general principles of food hygiene.

Appendix CAC/RCP 1-1969, Rev. 3 (1997) Guidelines for the application of the hazard analysis critical control point (HACCP) system.

Discussion paper on the implementation of HACCP in small and/or less developed businesses.

Preliminary draft guidelines on the use and promotion of quality assurance systems, CX/FICS 00/5, December 1999.

ISO 8402 – Quality management and quality assurance – Vocabulary.

ISO 9001 – Quality systems – Model for quality assurance in design, development, production, installation and servicing.

ISO 9002 – Quality systems – Model for quality assurance in production, installation and servicing.

ISO 9003 – Quality systems – Model for quality assurance in final inspection and tests.

ISO 9000-2000 – Quality management systems (in replacement of ISO 8402, 9001, 9002 and 9003, upon adoption by ISO).
