UNIVERSITY OF MOLISE

DEPARTMENT OF AGRICULTURAL, ENVIRONMENTAL AND FOOD SCIENCES
CAMPOBASSO

THE PRODUCTION OF ORGANIC TABLE OLIVES:TECHNOLOGIES AND PERSPECTIVES

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DEFINITION OF TABLE OLIVE

As defined by the International Olive Council (IOC), the table olives are:

"The healthy fruits of specific varieties of cultivated olives, picked at the right point of ripeness and of such quality that, after extensive work, give an edible food and good preservation."

Technologies used in the table olives processing

The olives usually are collected at different stage of maturity and then processed to eliminate the characteristic bitter taste due to the glucoside namely oleuropein.

The table olives debittering process can be accomplished using two ways:

-The “Chemical method” (Spanish style)

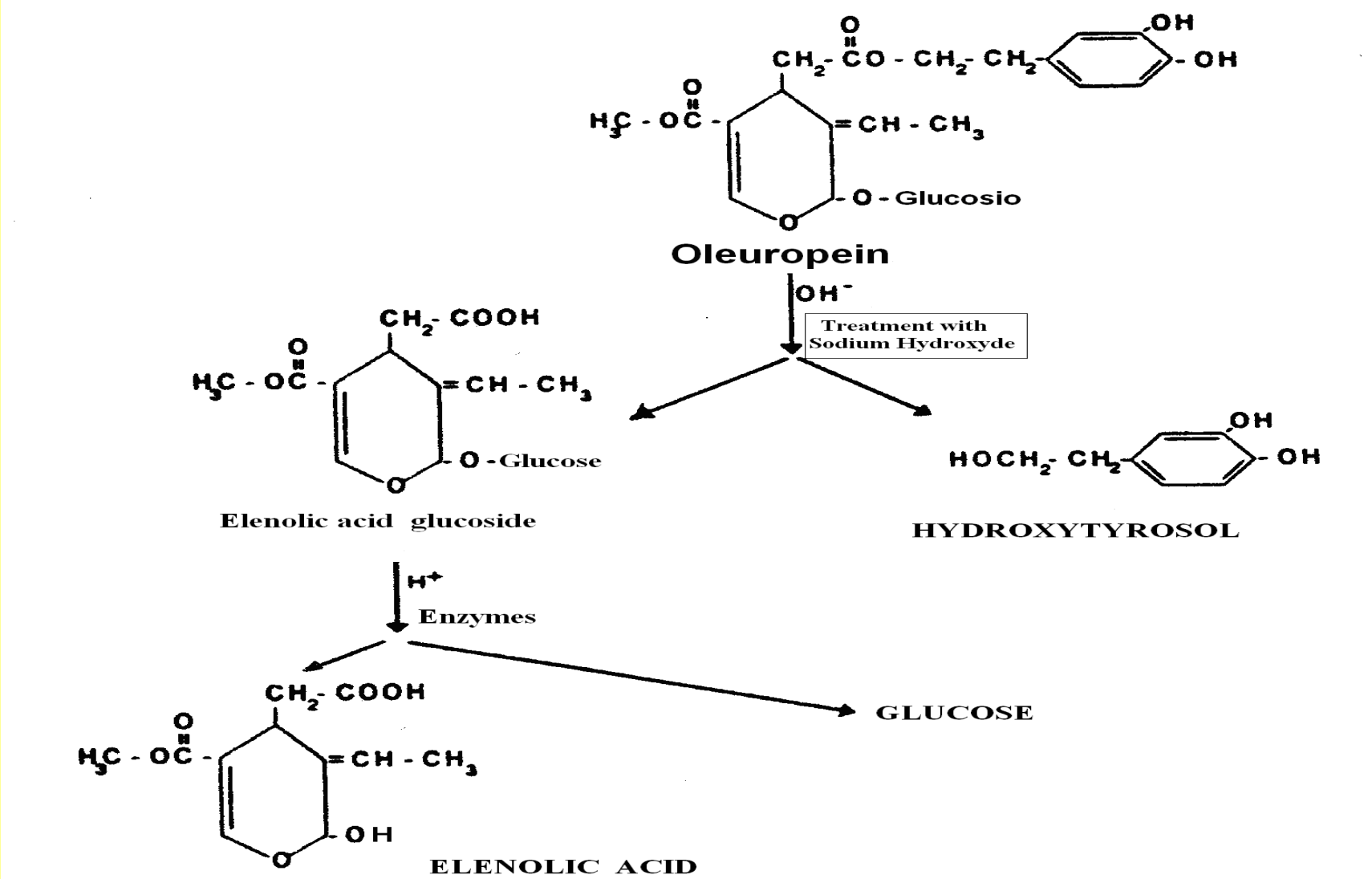
-The “Naturale method” (Organic style)

Difference between olives processed using the “naturale method” (organic) or the "Chemical method" (Spanish style and Californian style)

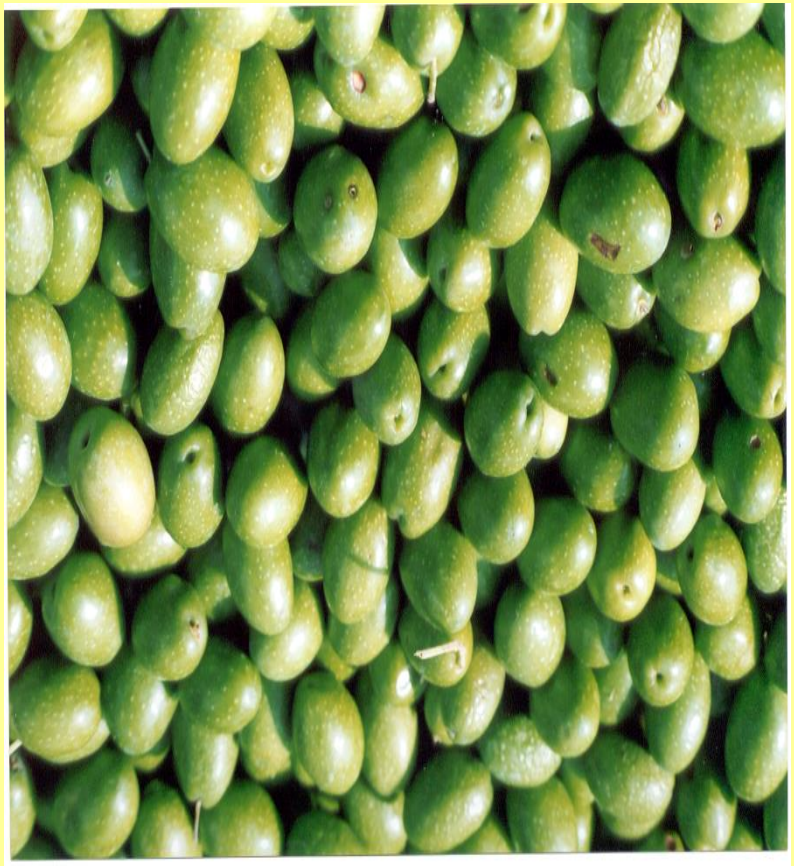
The “chemical method” (Spanish style)

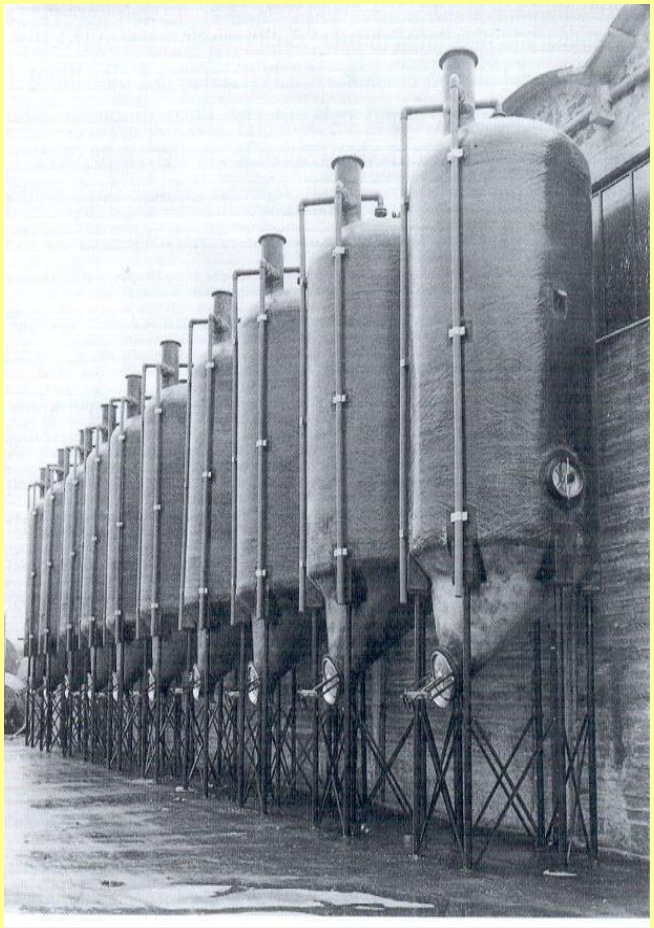
The chemical method known as Spanish or Californian style, consists of alkaline treatment with sodium hydroxide, which is following by several water washings of the fruits to remove the residual of the lye and then the fermentation in the brine with 5-6% of NaCl.

Chemism of the oleuropein hydrolysis by chemical treatment (Spanish style)



Debittering of green table olives through the alkaline hydrolysis of the oleuropein (Spanish style)



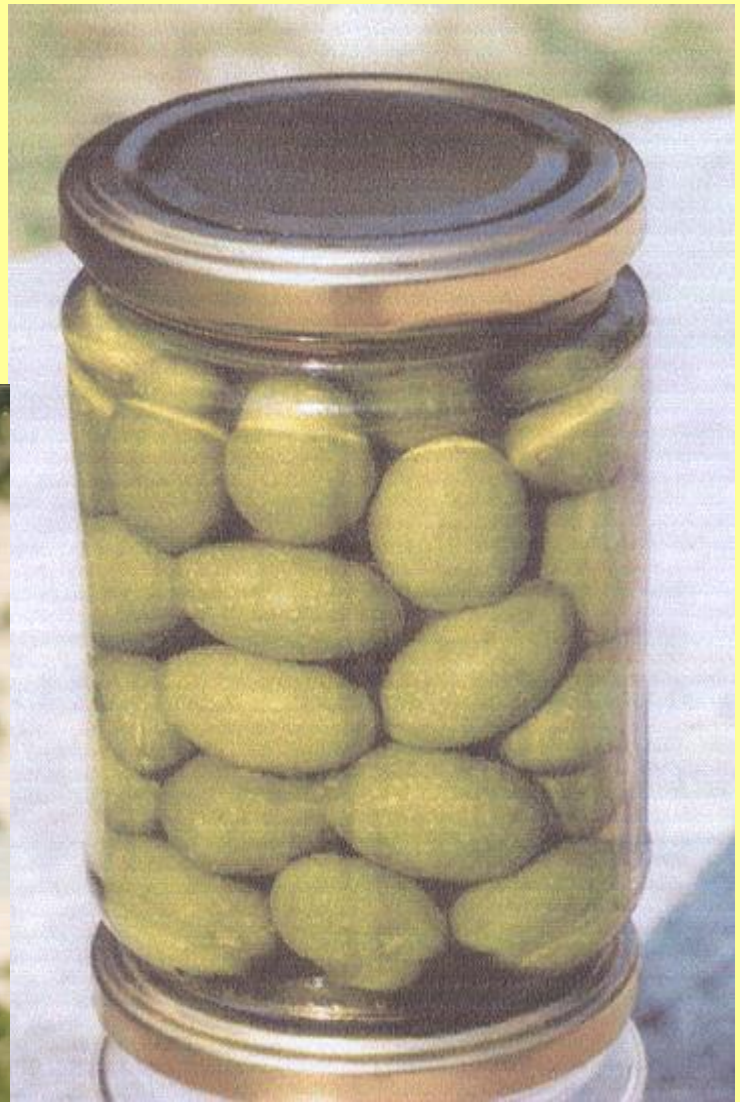


Series of large industrial fermenters

Small fermenter for table olives

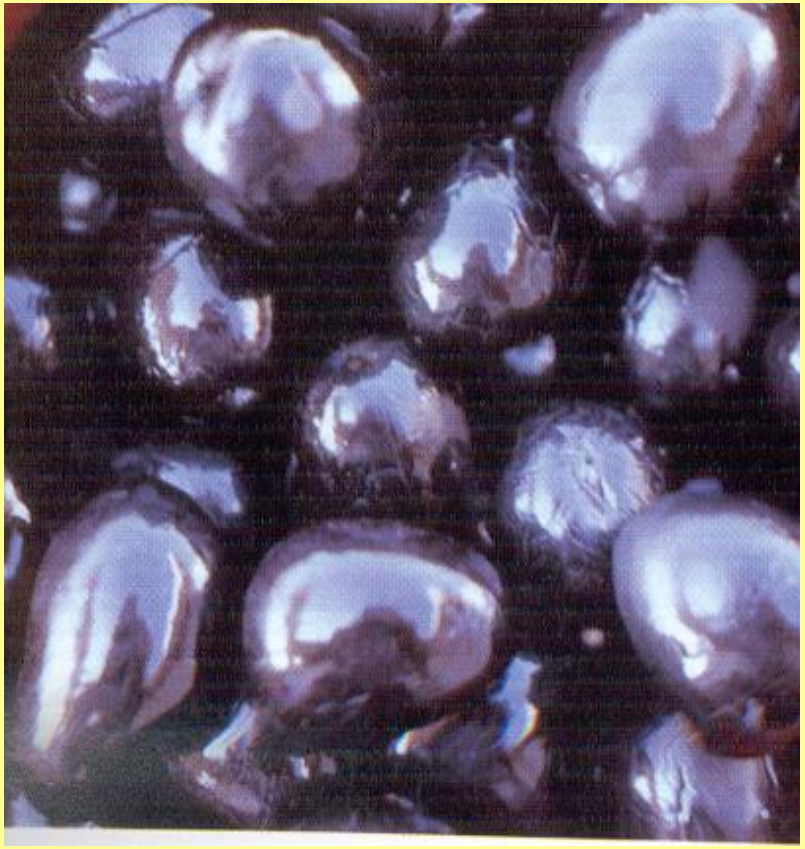
Lactic acid bacteria responsible for the fermentation of the fruits after the chemical debittering process

Green table olives processed chemically, packaged and pasteurized, found in the market



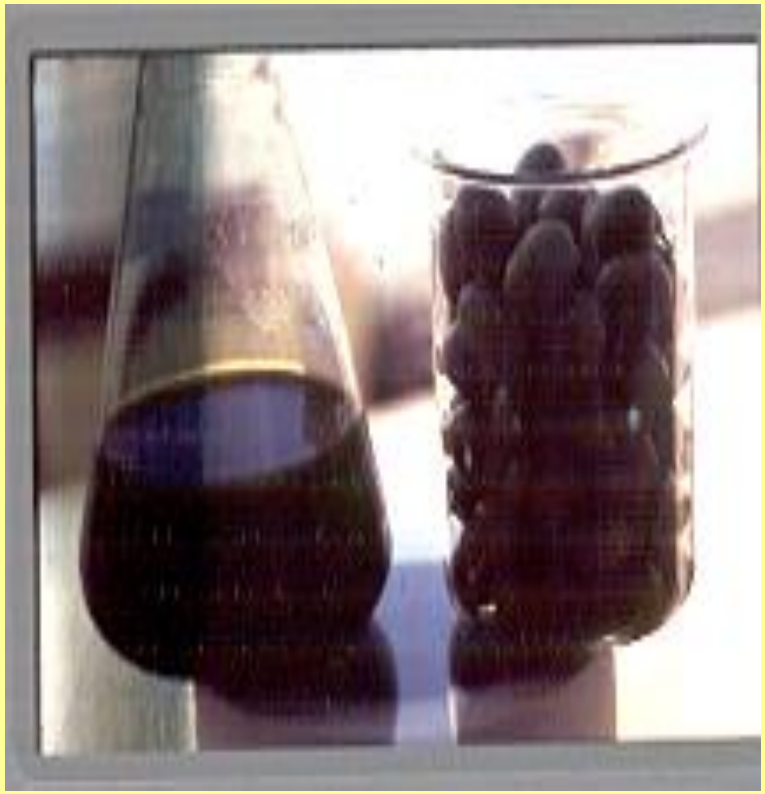
Olives produced with the chemical method according to the Californian style

Olives produced in advance with the Spanish style (green) and then blackened using air and iron salts according to the Californian stile



Black table olives produced by the chemical method according to the Californian style

Types of wastewater produced by the debittering process of table olives using the chemical method



Lye produced after the treatment of the fruits (pH 9)

Wastewater produced by the washing of the olives after the treatment with sodium hydroxyde (ratio processed olives / wastewater produced = 1: 5)

Positive and negative aspects of the chemical method of debittering

Positive aspects:

-standardized taste of the different products;

-products well known on the market through the publicity.

Nagative aspects:

-High cost of production;

-High environmental impact;

-Low nutritional and salutistic quality.

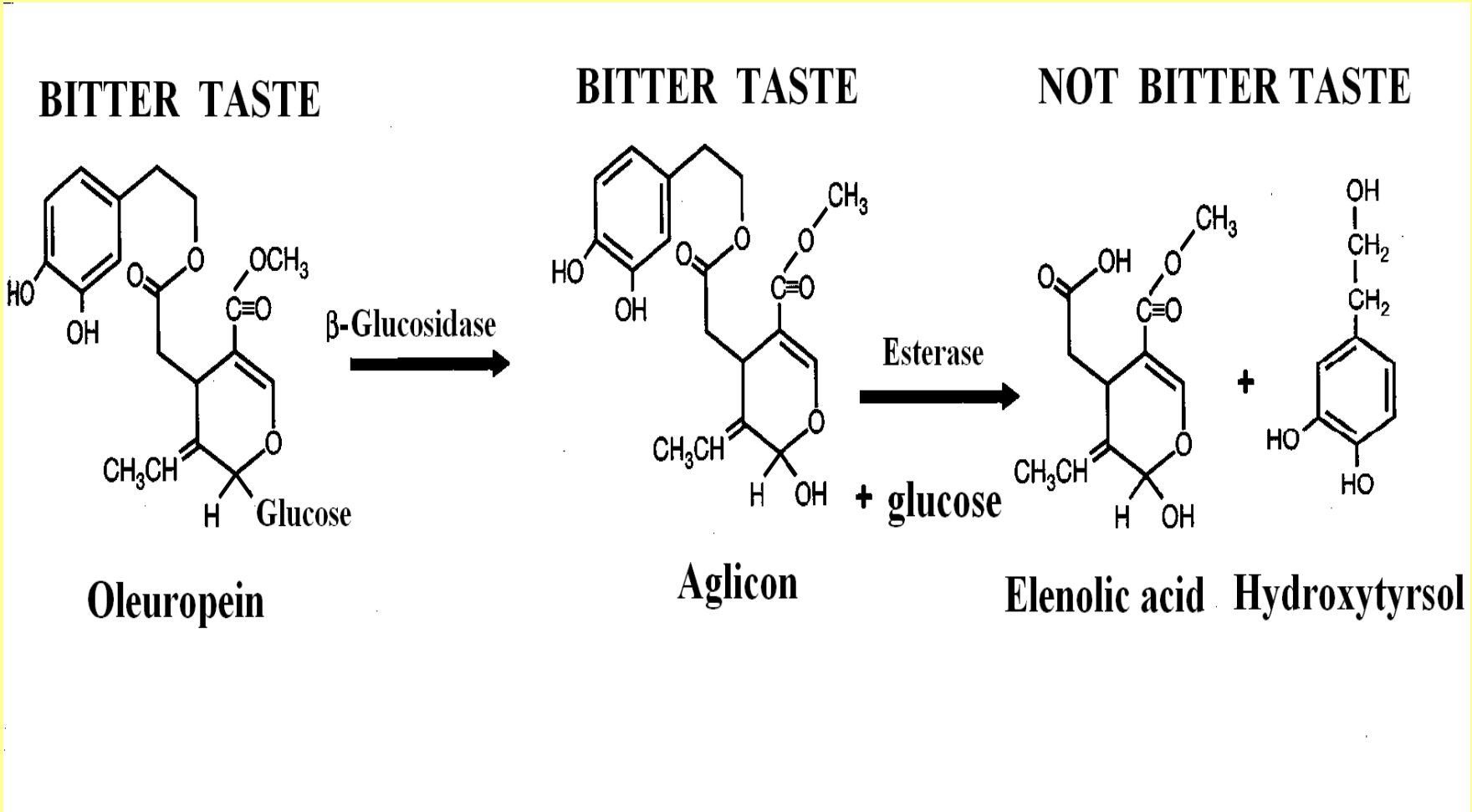
The “Naturale method” (Organic style)

The "natural method" is also known as Greek or Microbiological method.

The natural method does not require any chemical treatment of the fruits which are placed directly in to brine (6-10% NaCl), in which the fermentation takes place.

The hydrolysis of oleuropein is attributed to the enzymatic reaction of ß-glucosidase and esterase produced by the microorganisms.

Chemism of the oleuropein hydrolysis by “Natural” method (Organic)



Use of *Lactobacillus plantarum* as a starter

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Hydrolysis of Oleuropein by *Lactobacillus plantarum* Strains Associated with Olive Fermentation

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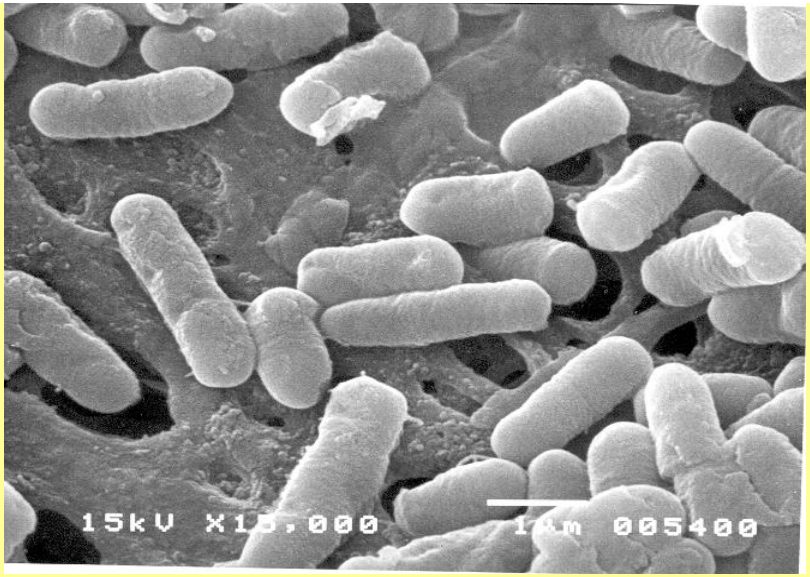
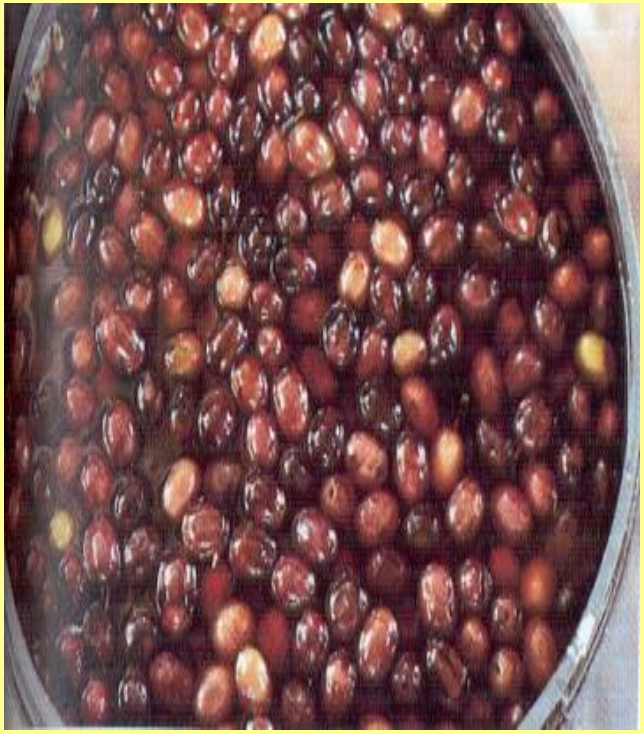


Some phases of the table olives processed with the "natural method"

Black table olives harvested for processing

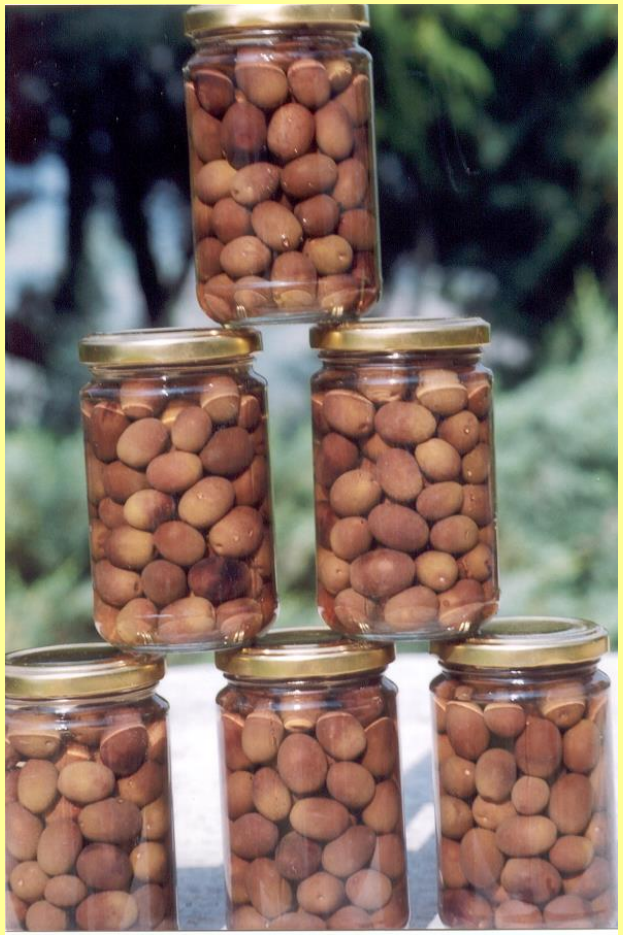
Fermentor



Black table olives in the brine during the fermentation

Small fermenters with olives in brine inoculated whith *L. plantarum* during the debittering process

Table olives characteristics after processing by the "Natural method"



Some vantages of the “Natural method” compared to the “chemical method”

Ecological aspects:

The table olives processed using the "Natural Method" produces less pollution compared to "Chemical method“:

-For every 100 kg of olives processed using the "Chemical method" are produced 500 kg of wastewater

-For every 100 kg of olives processed with the "Natural method" usually are produced about 80 Kg of wastewater

Color difference between two wastewater produced respectively with the "Chemical and Nautarl method"

Economical aspects:

-The table olives processed using the "Natural method" are characterized by a lower cost of production compared to"Chemical method";

-They may also be marketed as organic olives

Industrial bioreactors in fiberglass used in the "Chemical method"

Plastic fermenters used in the "Natural method"

Qualitative characteristics of the organic table olives and future perspectives

The olives processed with the "Natural method", are qualitatively superior to those produced with the "Chemical method".

-The "Natural" processed olives are caratterizzated by an higher content of biophenols;

-Furthermore their lipids content is represented by extravirgin olive oil, whereas in the chemically treated olives it is possible to find only lipids belongs to the commercial category of refined olive oils

Unlike the natural method, the chemical composition of the olives processed chemically undergoes deep changes due to the treatment with the NaOH.

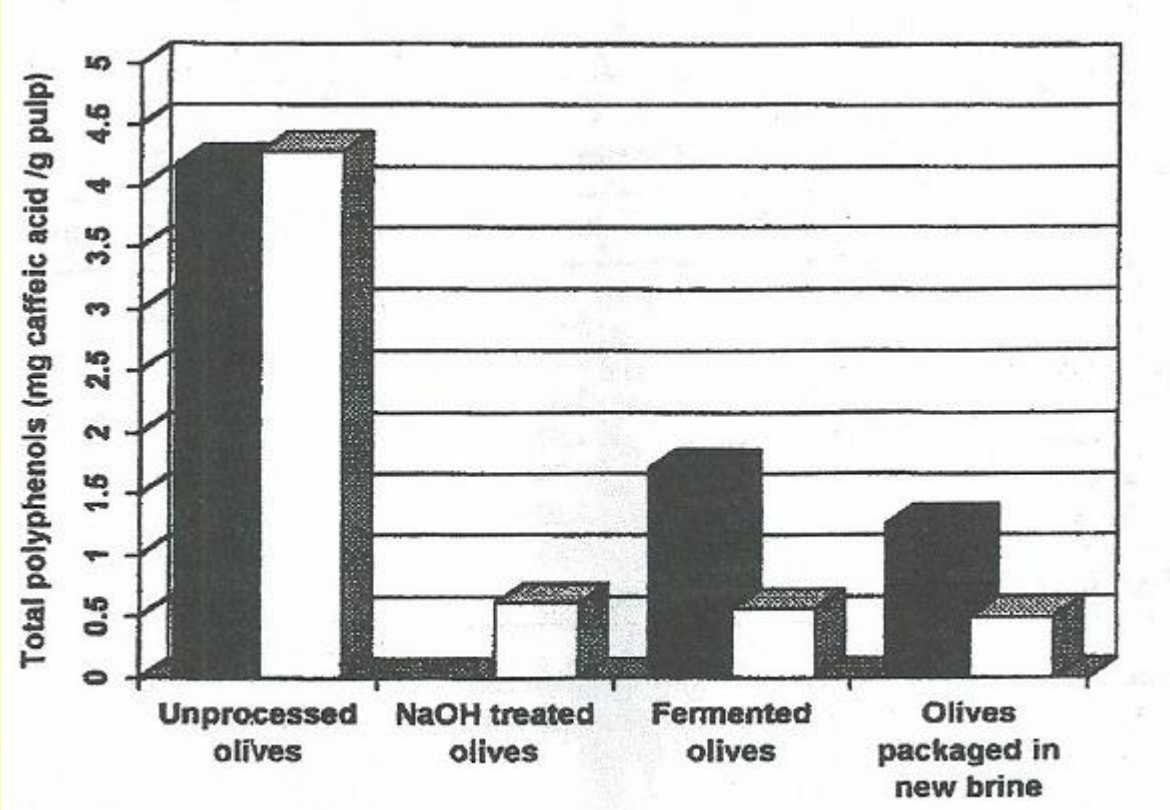
Difference between black olives processed with the "Natural method" and those artificially blackened with the air and ferrous salts according to the Californian style (chemical method)

Biophenol content of the “Natural” processed table olives

The "Natural" processed table olives are more rich in biophenol compared to that processed "Chemically", in fact, in the first one it is possible to retain about the 40% of the initial polyphenol level of the original unprocessed fruits, whereas in the latter more than 90% of the original natural biophenols usually are lost by leaching during the rinsing phase of the fruits previously treated with NaOH.

The high content of biophenols ensures a low level of the degree of oxidation of triglycerides present in the processed fruits as well as salutistic activities in the human body.

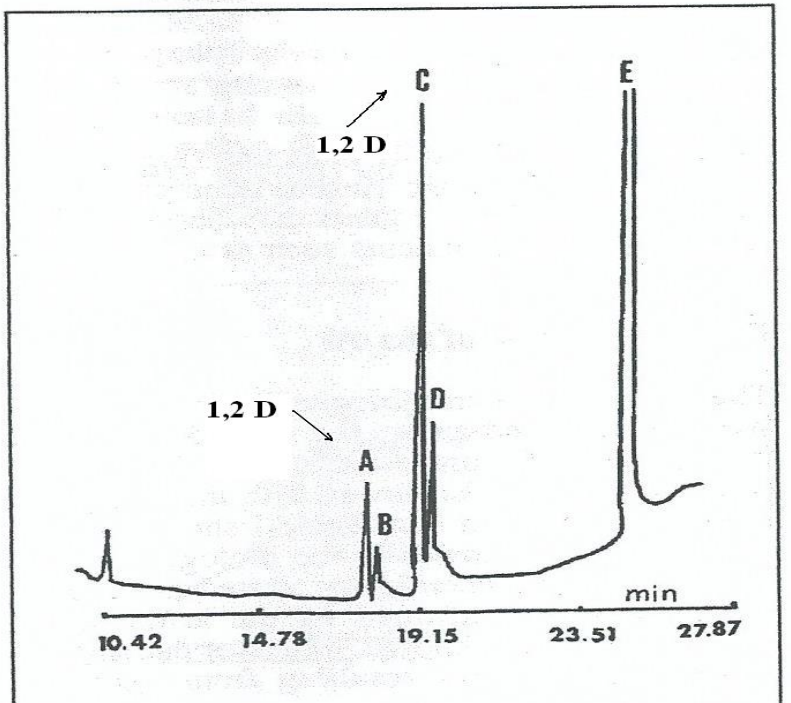
Total polyphenol (biophenols) found in the pulp of the table olives processed with the “Natural” (■) or the “Chemical” (□) method.



Characteristics of the lipids present in the pulp of the “Natural” processed table olives

The lipids of the "Natural" processed table olives is represented by extravirgin olive oil characterized by a low degree of oxydation. In fact, the isomeric forms of 1,2-diglycerides (characterizing the high quality of the extravirgin oils), are predominant on the 1,3-diglycerides forms, that are typical of the refined olive oil.

Distribution of the 1,2 and 1,3 diglicerisdes isomeric forms in the table olives processed using the "Natural" and the "Chemical" method.



HRGC chromatogram of diacylglycerol derived from the oil in table olives processed microbiologically.

A = 1,2-diglycerides (C34 fatty acid); B = 1,3-diglycerides (C34 fatty acid); C = 1,2-diglycerides (C36 fatty acid); D = 1,3-diglycerides (C36 fatty acid); E = standard

“Natural” method

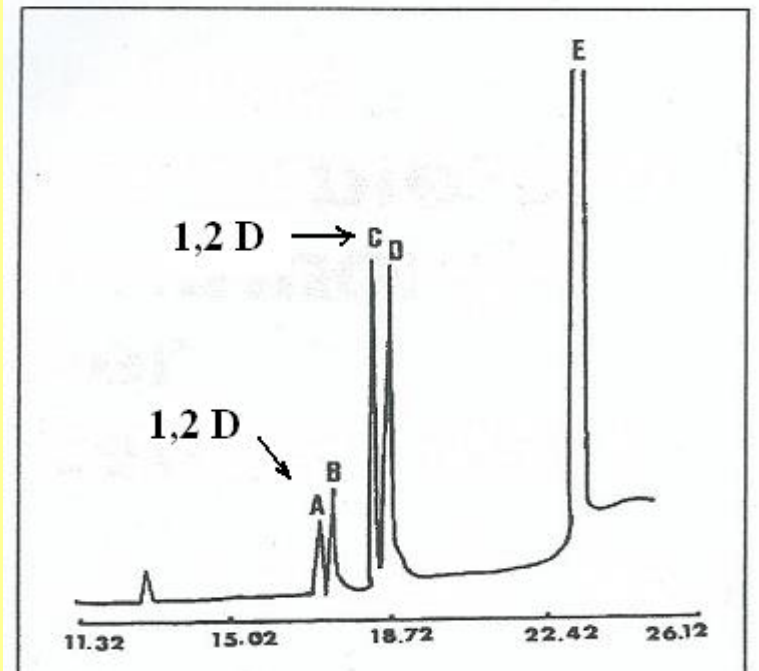


Figure 4: HRGC chromatogram of diacylglycerol derived from the oil in table olives processed chemically.

A = 1,2-diglycerides (C34 fatty acid); B = 1,3-diglycerides (C34 fatty acid); C = 1,2-diglycerides (C36 fatty acid); D = 1,3-diglycerides (C36 fatty acid) E = standard

“Chemical” method

CONCLUSIONS

The “Natural” debittering is a mild system that does not entail any chemical treatment, it is able to keeps most of the original fruit quality unchanged even after several month of storage.

The low cost of transformation, the low environmental impact and the high nutritional and salutistic quality of the product, are the main strengths that justify the continues expansion and replacement of the "Chemical" method of processing of the table olives with the "Natural" (Organic) system.

Thanks for your attention