FACTS ABOUT

Processing Aids for Improved Olive Oil Extraction

It has been estimated that the current industrial efficiency of the Australian olive oil industry ranges between 75 and 87 per cent.

For the industry, each additional percentage point of improved efficiency through the proper use of processing aids would represent approximately $500 000 worth of oil per year at current production levels.

This fact sheet presents the evaluation of a number of processing aids and their impact on olive oil extraction and oil quality. The information will help olive oil producers who are considering the introduction of processing aids to their normal processing practices.

Processing aids add value to olive oil

Processing aids have been used in the olive oil industry for more than 30 years in order to improve the extractability of oil from olive paste and decrease the loss of oil in pomace (remnant solids after oil extraction) for certain olive varieties.

Talcum powder, enzymes, common salt and warm water dipping are some of the most commonly used processing aids and techniques.

The individual and/or combined usage of these processing tools on olive pastes in European countries has been reported to improve oil extraction between 10–30 per cent.

In addition, recent research has shown a beneficial impact of some processing aids on oil quality. The appropriate use of talcum powder and enzymes as processing aids has been also reported to reduce the pollution potential of the processing waste water stream by up to 30 per cent.

The evaluation process and results

Evaluation of the use of processing aids and techniques on the extractability of olive paste and oil quality was done at both laboratory level and commercial scale in groves from central and northern Victoria. Fruit from three different commercial varieties (Manzanilla, Barnea and Arbequina) was used; each of the trialled varieties having a clearly different paste processing difficulty level and oil chemical profile.

Where to find the full research publication

The full report, *Evaluation of processing aids for olive oil extraction and quality improvement*, RIRDC publication no. 11/091, by Pablo Canamasas and Leandro Ravetti can be downloaded from the RIRDC website at https://rirdc.infoservices.com.au/items/11-091

Australian Government
Rural Industries Research and Development Corporation

All of the processing aids and practices evaluated are allowed for use in olive oil production under current Australian codes of practice (Australian Olive Association 2008) and included:

- normal talcum powder (talc)
- micro talcum powder (microtalc)
- different enzymes (from Novozymes Australia Pty Ltd)
- common salt (NaCl)
- calcium carbonate ($CaCO_3$)
- warm water dipping.

Addition of coadjuvants occurred at the beginning of the malaxing step during extraction. For warm water dipping, olives were immersed in a thermostatic water bath at set temperatures for a period of 5 minutes prior to oil extraction. Paste extractability was evaluated in each treatment.

Oil quality was assessed through a series of chemical analyses including: free fatty acids, peroxide value, UV coefficients, bitterness, total polyphenols, polyphenol profile, colour, 1,2-diacylglycerols, pyropheophytins and panel test.

Paste extractability

Table 1 shows results for paste extractability for all processing aids evaluated. All solid aids evaluated provided higher paste extractability than the control, and were particularly more effective with higher-moisture fruit such as Manzanilla. The use of enzymes showed better paste extractability with Arbequina and Barnea fruit, but provided poorer results with Manzanilla fruit. It is likely that Manzanilla's high fruit-moisture levels generated emulsions that limited enzymatic action, and enzyme performance might be improved by the prior addition of solid processing aids. Warm water dipping showed a slight improvement in extractability only at 60°C.

Oil quality

The oil quality produced from all solid aid and enzyme treatments was extra virgin according to International Olive Council standards. The use of enzymes did not show any significant difference from controls in oil quality. Talc and microtalc

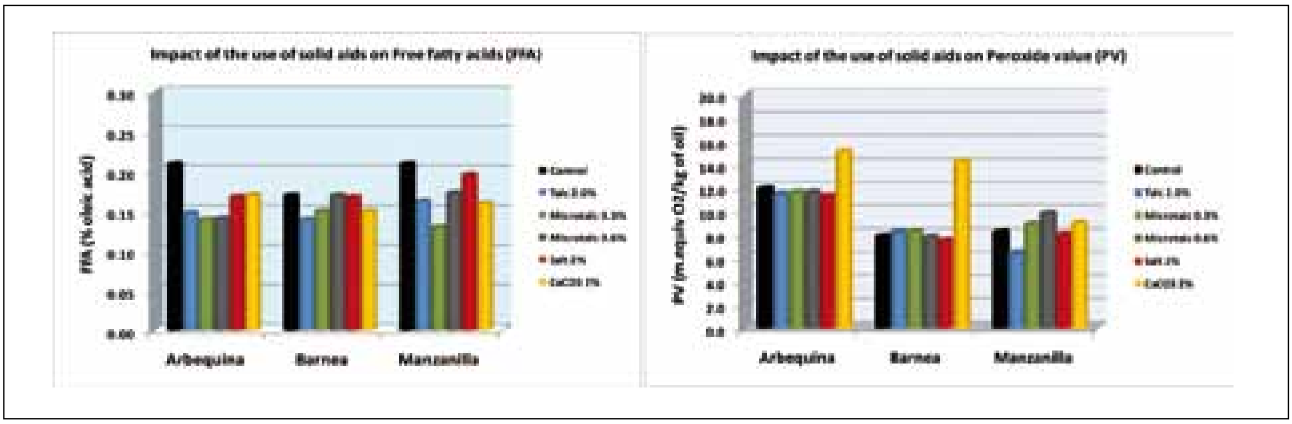

Figure 1. Impact of processing aids on olive oil quality as measured by a) free fatty acids; and b) peroxide value

also did not have any significant impact on oil quality; however, calcium carbonate led to some negative changes in the chemical and organoleptic composition of the oil (Figure 1). Increased water temperature also led to negative changes in oil chemical and organoleptic characteristics, including an increasing intensity of green colour (Figure 2).

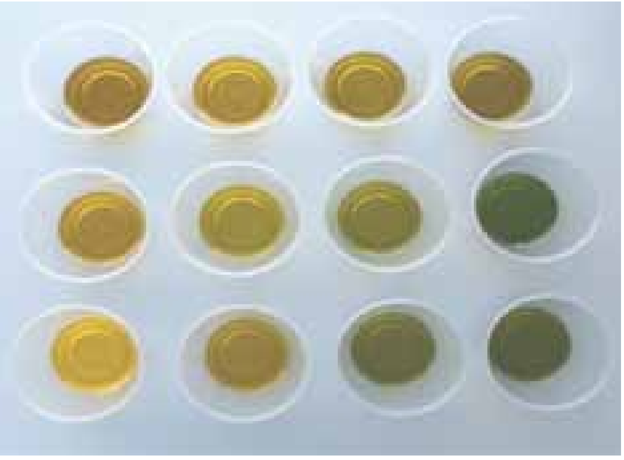

Figure 2. Oil colour in control treatment (without water dipping) and treatments with water dipping at 30°C, 45°C and 60°C in varieties Arbequina, Barnea and Manzanilla

Table 1. Paste extractability results (values in %) in Arbequina, Bamea and Manzanilla fruit with the use of different processing aids and techniques using Abencor® in 2009[1]

Paste extractability results (values in %) in Arbequina, Barnea and Manzanilla fruit with the use of different processing aids and techniques using Abencor® in 2009[1]

	Arbequina	Barnea	Manzanilla
Control	8.4% b	11.0% b	2.8% b
Talc powder (2.0%)	9.9% a	12.6% a	4.5% a
Microtalc powder (0.3%)	10.2% a	12.0% ab	2.7% b
Microtalc powder (0.6%)	10.2% a	12.2% a	4.3% a
F[2]	35.85	7.659	35.14
Significance	< 0.0001	0.0097	< 0.0001
Control	8.4% c	11.0% a	3.3% b
Common salt (2.0%)	9.8% b	11.8% a	3.2% b
Calcium carbonate (2.0%)	10.7% a	12.1% a	7.1% a
F[2]	26.62	5.112	244.5
Significance	0.001	0.051	< 0.0001
Control	8.2% d	10.1%[3]	4.2% a
Pectinex Ultra SP-L (0.3%)	10.2% b	12.4%[3]	0.9% c
NZ 33095 (0.3%)	10.5% a	15.5%[3]	2.4% b
NZ 33095/Celluclast 1.5 (0.3%)	9.6% c	12.6%[3]	2.3% b
Viscozym L (0.3%)	9.5% c	16.4%[3]	2.2% b
F[2]	26.57		53.5
Significance	< 0.0001		< 0.0001
Control	8.0% a	12.1% a	5.1% a
30°C	7.5% a	11.1% b	4.2% d
45°C	6.9% a	10.4% b	4.8% b
60°C	8.3% a	12.3% a	4.5% c
F[2]	2.573	13.3	7.397
Significance	0.13	0.0018	0.011

[1] Means followed by the same roman letter do not present significant differences (Duncan's multiple range test $\alpha = 0.05$)

[2] F tests the efect of the processing aid or technique

[3] Results obtained at processing plant level

What this means for the producer

This study confirmed the beneficial impact of processing aids such as talc, microtalc, calcium carbonate, salt and enzymes on processing efficiency for three olive cultivars (Arbequina, Barnea and Manzanilla). This was especially the case when dealing with high-moisture fruit.

Olive varieties with high fruit-moisture levels tend to produce oil/water emulsions during the crushing step of the extraction process and solid aids such as talc, microtalc and calcium carbonate (in doses lower than 1.0 per cent) have been useful in breaking down those emulsions thus provided higher paste-extractability without impacting on oil quality.

Apart from Manzanilla, other varieties that tend to show high fruit-moisture levels are Picual, Hojiblanca, Leccino, Arbequina, and most table olive varieties that are processed for oil extraction.

A number of different enzymes (pectinases and/ or cellulases, individually or in combination) were demonstrated to be very effective in changing the rheological properties of the olive paste, resulting in a significant impact on paste extractability. The enzyme treatment tends to be more effective with low-maturity fruit and when the pectin content in pulp cell walls is high. However, to improve their effectiveness on pastes coming from high-moisture fruit, enzymes might require the prior addition of a solid aid. Due to their high biological specificity, enzymes used for olive oil processing do not alter the fatty acid composition of the oil and thus have no significant impact on oil quality.

Finally, while the improvement in paste extractability translates into more oil extracted, it is important to highlight that, at the same time, a more exhausted olive waste is also a more environmentally friendly pomace if it is going to be composted or spread back directly onto groves.

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This fact sheet is an addition to RIRDC's diverse range of over 2000 research publications and it forms part of our New Industries/Olives R&D program, which aims to:

- Provide information which establishes the benefits of Australian olive products
- Maintain the current high quality product while improving productivity, profitability and environmental management through all stages of the supply chain
- Develop strategies for existing and new olive producers to reduce the effects of climate change and variability
- Build an educated, collaborative, innovative and skilled industry workforce and a cost effective, well-funded RD&E program.
- Most of RIRDC's publications are available for viewing, free downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

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