STEAM AND OTHER TREATMENT OPTIONS FOR CONTAMINATED MACADAMIA KERNELS

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INTRODUCTION

Australian macadamia industry members have been concerned if effective treatments are possible for kernel batches suspected or found to be contaminated - either high microbial levels (bacteria or moulds) or presence of key microbes of concern (eg Salmonella or E. coli). This project examines the potential for four alternative technologies to remedy these problems.

METHODS

Treatment technologies

Four alternative treatment technologies were applied to macadamia kernels to assess effectiveness in reducing microbial levels and eliminating organisms of concern:

1. Steaming and drying: 100°C steam for 10 sec - 30 min, followed by oven at 70°C, 90°C or 110°C for 5-25 min;
2. Water dipping and drying: 22°C dip for 1-10 min, followed by oven at 90°C or 110°C for 15-60 min;
3. Hydrogen peroxide (H_2O_2) dipping and drying: 0.5%-20% H_2O_2 solution (22°C) for 10 sec-5 min, followed by oven at 90°C or 110°C for 10-60 min;
4. Ultra-violet light (UV) exposure: 25 cm x 150 Watt/2.5 cm <280 nM wavelength mercury vapour lamp at 10-30 cm distances (intensities) for 3-10 sec.

Microbial inoculation status

Three separate trials were carried out to assess effects on different micro-organisms on the kernel surfaces:

A. Uninoculated: raw commercially available kernels;
B. E. coli inoculated: raw kernels surface coated with E. coli contaminated powder;
C. Salmonella inoculated: raw kernels surface coated with Salmonella contaminated powder.

Microbiological counts

Appropriate microbiological tests on kernel surfaces were performed before and after treatments to measure effects:

I. Standard bacterial plate count (SPC) /g;
II. Mould count (MC) /g;
III. Coliform bacterial count (CC) /g;
IV. E. coli presence (ECP) /g;
V. Salmonella presence (SP) /g.

Replication

Three separate batches (replicates) of macadamia kernels were used for each experiment.

RESULTS

Figure 1 displays a typical set of steaming and drying results, showing that SPC, MC and CC values were reduced to 0.1-1.0% of the control and *E.coli & Salmonella* were eliminated.

Figure 2 displays some of the better water dipping and drying results, showing the long drying times needed to give large reductions in SPC, MC and CC, but *E.coli & Salmonella* were not eliminated. H_2O_2 dipping and drying results are not displayed; they were intermediate between steaming and water dipping, but caused kernel changes.

Figure 3 displays the weak effects of the UV exposures tried.

Fig 1. Effect of steaming macadamia kernels for 45 sec and 90°C drying on microbiological results
(Treated sample results expressed as % of control sample results)

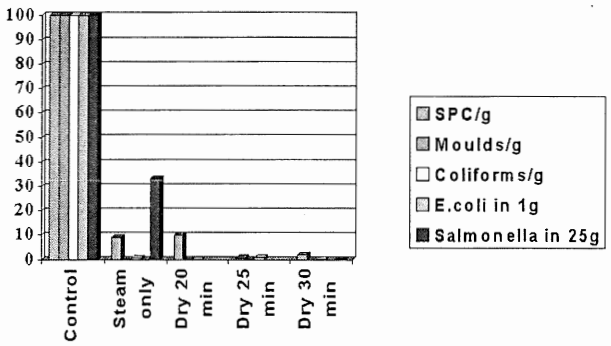


Fig 2. Effect of water dipping macadamia kernels for 10 min and 90°C drying on microbiological results
(Treated sample results expressed as % of control sample results)

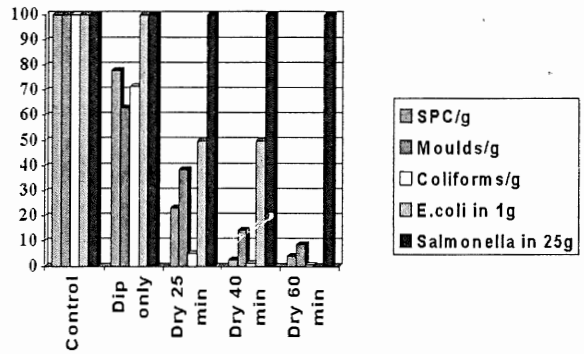
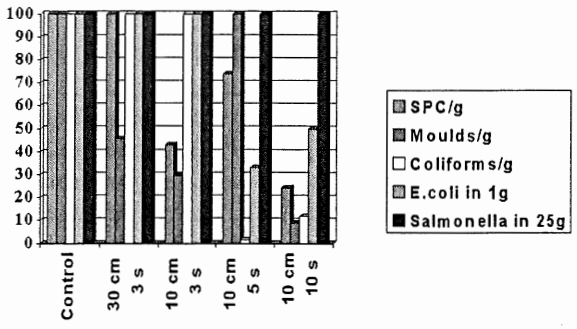


Fig 3. Effect of UV exposure of macadamia kernels at 10-30 cm for 3-10 sec on microbiological results
(Treated sample results expressed as % of control sample results)



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CONCLUSIONS

1. Steaming at 100°C for 45 sec followed by drying at 90°C for 25 min effectively reduced microbial surface loads to acceptable levels and eliminated E. coli and Salmonella.
2. Water dipping followed by drying at 90°C or 110°C was very ineffective unless very long drying times (45-60 min or more) are employed.
3. H_2O_2 dipping followed by drying at 90°C or 110°C is generally not as effective as steam, (and textural and visual changes in kernel surfaces are caused by strong solutions and long dip times). Until solutions exceed 8%, dipping times exceed 30 sec and drying times exceed 15-30 min, it is not much more effective than water dipping and drying.
4. UV exposure at the intensities and times used was relatively ineffective compared to steaming and drying.

GROWER PARTICIPATION IN COMMUNICATION ACTIVITIES WITHIN THE AUSTRALIAN MACADAMIA INDUSTRY

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Effective communication of research and development information is a critical activity for primary production industries. This is especially true for those competing on a global scale, such as the Australian Macadamia industry. The Australian Macadamia Society has developed a number of communication strategies: the Newsletter, the electronic Bulletin Board, Macgroups, and so on. However, developing the strategies is not enough, they need also to be evaluated.

The aims of this project are to ascertain the actual use of the communication channels by members of the society, and to clarify what people look for in an effective source of industry information. A survey was used to gather this information, and conclusions drawn from it are to be challenged by consulting with Macgroup participants. The results from the survey response presented here are preliminary and open discussion of them is invited.

The benefits of this research are that it contributes to the continual development of effective and appropriate communication strategies that will help maintain the global competitiveness of the Australian Macadamia nut industry.

ESTABLISHING A TRAINED TASTE PANEL FOR THE ASSESSMENT OF RAW AND ROASTED MACADAMIA NUTS

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Forty-eight people were selected from a database of experienced tasters established at the Centre for Food Technology. Only 24 tasters were selected to proceed based on availability, eating habits, health status, dietary restrictions and allergies as well as their performance in screening triangle tests which covered staleness, rancidity, nut hardness and bitterness.

Following a brainstorming session, endpoint anchors for the most important scales were presented to the panel in a series of round table discussions. Individual tasters performance was measured by presenting them with five very different samples in three replicated sessions and after statistical analysis their F ratios and residual mean square for each attribute were investigated. Fourteen of the best tasters were then selected for additional training.

Further brainstorming and training was completed using structured unipolar and bipolar scales utilising a good quality commercial nut as a reference. The following scales were confirmed for assessing raw macadamia nuts:

Overall appearance/Appearance quality
Dominant colour/Colour intensity
Hardness
(Characteristic raw) macadamia nut flavour intensity
Sweetness
Rancid flavour intensity
Stale flavour intensity
Other flavour intensity
Overall quality

A simple extension of the taste panel from assessing raw to the assessment of roasted macadamia nuts identified the requirement for 'characteristic roast macadamia nut flavour' and 'roast flavour' scales.

The panel is now fully trained and is routinely used for the assessment of both raw and roasted macadamia nuts arising from trials conducted here at the Centre and elsewhere. The panel is frequently calibrated and individual performance monitored.