Sanguinetti, Anna Maria; Secchi, Nicola; Del Caro, Alessandra; Catzeddu, Pasquale; Roggio, Tonina; Stara, Giuseppe; Madrau, Monica Assunta; Piga, Antonio <1965- > (2009) *Effectiveness of active and modified atmosphere packaging on the shelf-life extension of a cheese tart*. Italian Journal of Food Science (Special Issue), p. 118-121. ISSN 1120-1770.

http://eprints.uniss.it/5186/
SLIM 2008
Shelf-life International Meeting

Ischia, June 25-27th 2008

Edited by
GIOVANNA G. BUONOCORE & ELENA TORRIERI

Special Issue
ITALIAN JOURNAL OF FOOD SCIENCE

CHIRIOTTI EDITORI
This Special Issue of the Italian Journal of Food Science collects the presentations given at the “SLIM 2008, Shelf Life International Meeting” organized by GSICA, National Research Council – IMCB, University of Naples – DSA and DIMP, held at Ischia on June 25-27th 2008.

These papers were reviewed by the Scientific Committee of the congress before their presentation but they did not undergo the conventional reviewing system of the Italian Journal of Food Science.

Chiriotti Editori s.a.s. - Pinerolo - Italy

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ISSN 1120-1770
ITALIAN JOURNAL OF FOOD SCIENCE
(RIVISTA ITALIANA DI SCIENZA DEGLI ALIMENTI)

Property of the University of Perugia
Official Journal of the Italian Society of Food Science and Technology
Società Italiana di Scienze e Tecnologie Alimentari (S.I.S.T.A.I)
Initially supported in part by the Italian Research Council (CNR) - Rome - Italy
Recognised as a “Journal of High Cultural Level”
by the Ministry of Cultural Heritage - Rome - Italy

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E-mail: info@chiriottieditori.it - URL: www.chiriottieditori.it

Aim: The Italian Journal of Food Science is an international journal publishing original, basic
and applied papers, reviews, short communications, surveys and opinions in food science
(chemistry, analysis, microbiology), food technology (engineering, processing) and related
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rests with the referees.

Frequency: Quarterly - One volume in four issues. Guide for Authors is published in each
number and annual indices are published in number 4 of each volume.

Impact Factor: 0.518 published in the 2007 Journal of Citation Reports, Institute for Scientific
Information

Subscription Rate: 2009: Volume XXI
PDF version € 40.00
Ordinary € 150.00
Supporting € 1,000.00

IJFS is abstracted/indexed in: Chemical Abstracts Service (USA); Foods Adlibra Publ. (USA);
Gialine - Enzia (F); Institut Information Sci. Acad. Sciences (Russia); Institute for
Scientific Information; CurrentContents®/AB&ES; SciSearch® (USA-GB); Int. Food
Information Service - IFIS (D); Int. Food Information Service - IFIS (UK); EBSCO
Publishing; Index Copernicus Journal Master List (PL).

IJFS has a page charge of € 20.00 up to 5 pages; extra pages are € 30.00.
Reprints (100) will be sent free of charge.

III
EFFECTIVENESS OF ACTIVE AND MODIFIED ATMOSPHERE PACKAGING ON THE SHELF-LIFE EXTENSION OF A CHEESE TART

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ABSTRACT

The shelf life extension by MAP and AP of a typical cheese tart was studied. Baked tarts were packaged inside barrier to gas trays and wrapped with a barrier to gas and water film. Four batches were prepared: 1) Control; 2) MAP with different N₂/CO₂ ratios (70/30 and 20/80); 3) Trays with an iron oxide-based oxygen absorber. Tarts were stored at 20°C and sampled for analysis at 0, 7, 14, 27, 35 and 48 days. Determinations included microbiological analyses (total bacterial count, moulds, yeast and staphylococci), chemical-physical parameters (pH, water activity and dry matter), gas changes (CO₂, O₂ and N₂) inside MAP and AP trays, texture evolution and sensory analysis at our laboratories.

AP allowed a shelf life of 48 days, MAP shelf lives were of 14 and 34 days for 70/30 and (20/80), respectively, while control tarts spoiled after only 7 days.

Key words: active packaging; modified atmosphere packaging; pastry products; shelf life.

INTRODUCTION

Ambient cakes are intermediate to high moisture bakery products, as they have about 20% moisture and water activity (a_w) ranging from 0.65 to 0.95 (Smith and Simpson, 1995; Jones, 2000). The main causes affecting their shelf-life are first of all microbial spoilage, mostly by moulds, and secondly staling (Smith et al., 2004).
The reduction of microbial spoilage of bakery products is preferably obtained by control of post baking contamination, mainly by using modified atmosphere (MAP) or active packaging (AP) (Smith and Simpson, 1995; Guynot et al., 2003a; Guynot et al., 2003b).

Extensive studies have been done on the effect of MAP and AP on the shelf life of different bakery products (Smith et al., 1988; Ooraikul, 1991; Smith and Simpson, 1995; Guynot et al., 2004), but, at our knowledge there are no reports on tarts with a cheese filling.

The aim of the present study was to verify the effects of MAP or AP packaging on extending the shelf life of a cheese tart.

MATERIALS AND METHODS

Cheese tarts were prepared following a traditional local recipe. Short pastry was prepared and pastry circles of 12 cm in diameter were obtained. The filling was obtained by mixing the different ingredients, mainly fresh grated ewe's cheese. An adequate amount of filling was layered in the center of the short crust circle, that was subsequently shaped to give a 8 cm in diameter tart. The tarts were baked at 180°C for 15 minutes in a rotor oven, cooled and packaged inside barrier to gas trays (two for each tray) and wrapped with a barrier to gas and water film. Four batches were prepared, the 1st being the control, the 2nd and the 3rd (MAP) by using different N₂/CO₂ ratios (70/30 and 20/80) and the 4th (AP) by placing a sachet of a iron oxide-based oxygen absorber inside trays. Tarts were stored at 20°C and sampled for analysis at 0, 7, 14, 27, 34 and 48 days. A ten-gram sample was homogenized in 90 mL of sterile water, and serial dilution was performed before plating. Total bacterial count, staphylococci, moulds and yeast were detected on appropriate media (CFU/g). Dry matter (dm), water activity (a_w) and pH were measured both on homogenized short pastry and filling. Texture was determined with a texture analyser (TA-XT2, Stable Microsystems, Surrey, UK) with a 50 kg load cell. Textural determinations were made in three tarts per each lot by using a blade set with knife edge for a cut test (HDP/BS), and a 5mm diameter cylinder probe (P/5), for a puncture test. Two indexes were used for both tests: a) maximum rupture force (as g); b) area under the curve (as g · mm) up to the maximum rupture force. The gas composition of at least three packages per each thesis were sampled and analyzed using a Combi Check 9800-1 gas analyzer (PBI-Dansensor, Denmark). Sensory analysis involved asking thirty-two untrained consumers to evaluate the overall acceptance of the samples by using an hedonic scale from 1 to 7 (1, terrible; 4, acceptable; 7, excellent) for colour, olfactory intensity, taste and consistency.

RESULTS AND DISCUSSION

The O₂ concentration inside MAP and AP packages was close to 0% at the start of the experiment and increased only on MAP, which did not exceed 0.40%. The product has an a_w value higher than 0.9, thus is very susceptible to mould growth (Guynot et al., 2003b). Control tarts evidenced mycelia after seven days of storage, while inhibition of mould growth was dependent on CO₂ concentration inside packages (Table 1). In fact, tarts spoiled after 14 and 34 days in 70/30 and
Table 1 – Total bacterial count (PCA)*, yeast and mould (GYPD) and staphylococci (BP) growth (as CFU/g) during storage of a cheese tart packaged with MAP or AP.

<table>
<thead>
<tr>
<th>Microbial</th>
<th>Packaging</th>
<th>Storage time (days)</th>
<th></th>
<th></th>
<th></th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>7</td>
<td>14</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td>PCA</td>
<td>Control</td>
<td>1.4x10^2</td>
<td>2.2x10^3</td>
<td>&gt;10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>70/30</td>
<td>1.4x10^2</td>
<td>9.8x10^3</td>
<td>2.1x10^3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>20/80</td>
<td>1.4x10^2</td>
<td>1.1x10^4</td>
<td>1.2x10^4</td>
<td>5.9x10^2</td>
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</tr>
<tr>
<td></td>
<td>Absorber</td>
<td>1.4x10^2</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<td>GYPD</td>
<td>Control</td>
<td>&lt;10</td>
<td>4.2x10^2</td>
<td>-</td>
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<tr>
<td></td>
<td>70/30</td>
<td>&lt;10</td>
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<tr>
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<td>20/80</td>
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<tr>
<td></td>
<td>Absorber</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>BP</td>
<td>Control</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>70/30</td>
<td>&lt;10</td>
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<td>Absorber</td>
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<td>&lt;10</td>
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</tr>
</tbody>
</table>

*PCA, Plate count agar; GYPD, Glucose yeast peptone dextrose agar; BP, Baird Parker Agar.

20/80 MAP packages, respectively, while the use of oxygen absorber prevented mould growth up to the end of storage. The number of total viable cells increased in tarts inside MAP packages up to 10^5 CFU, while no colonies were found on AP packaged samples. Staphylococci were not detected. Tarts evidenced a strong hardening of control samples after 7 days in storage, MAP tarts hardened after 14 days (only in the external part in 70/30 samples), while tarts with absorber did not show significant changes in texture at the end of the 48 days in storage (data not shown). Sensory analysis gave values over the acceptability threshold for all the storage period and no significant differences were detected among samples (data not shown).

REFERENCES


