TIA Technical conference
Amsterdam

Making tortilla for East Europe Market - How to extend shelf life and maintain a high quality of wheat tortilla

September 2018.

Tijana Lopitić - Vasić
Comparison shelf life of the tortilla on the market in different countries.

- Shelf life of tortilla in USA mostly is 3-4 weeks.

- Shelf life of tortilla in Europe is from few months to 1 years.
Factors that affect shelf life of tortilla

- Hygiene
- GMP
- Moisture
- Water activity
- pH
- Preservatives
- MAP Packaging
Shelf life of tortillas depends not only on the best by date on the packaging

- Ingredients
- Formulation
- Process
Remarks on the quality of the tortilla

✓ Notice any spots of mold on their surface

✓ Senses are usually the most reliable instruments that tortillas have expired - rancidity

✓ Sticking
Quality Problem- Mold growth

- Lack of sanitation practices, problems with production practices
- Recycling of unfiltered air in the bakery increases the changes of mold spores. Problems with bacterial/mold population in area
- Possible problems with pH
- Possible problems with preservatives
Preventing rancidity

✓ Choosing the right fat
  - Unsaturated fats tend to have a shorter shelf life
  - Saturated fats are more stable

✓ Avoid exposure to oxygen
  - MAP packaging for long shelf life, > 3 months
Choosing the right fat for longer shelf life of tortilla

- Coconut oil, palm oil, canola oil, avocado oil (12 months - shelf life)
- Corn oil (9-12 months - shelf life)
- Olive oil, macadamia oil, almond oil (6-12 months - shelf life)
- Soyabean oil, peanut oil (6 months - shelf life)
- Grape seeds oil, sunflower oil (3 months - shelf life)
- Walnut oil (2-4 months - shelf life)
Prevent microbiological contamination

- Reduction of microbiological contamination by baking in ovens at high temperatures more of 200 °C.
- Ovens sanitize
- Education people how to prevent product of microbiological contamination
- Practice high hygienic practice
Definitions of preservatives

Preservatives are antimicrobial agents used to preserve food by preventing the growth of microorganisms such as mold, yeast and bacteria.
Forms of preservation

- Artificial
- Clean label
- pH - Acidic
- Reducing water activity (aW)
- Modified atmospheric packaging
- UV Light
- Irradiation
- Freezing, refrigeration
- Fermentation
Types of preservatives

- **Propionates**
  - Calcium propionate
  - Sodium propionate
  - Propionic acid

- **Sorbates**
  - Potassium sorbate
  - Sorbic acid

- **Fermentation**
  - Cultured dairy whey
  - Cultured wheat
  - Cultured corn syrup solids
Cumulative effect of preservatives and acids

Barrier against spoilage

- Fumaric acids
- Potassium sorbate Sorbic acids
- Calcium propioanate Propionic acids
Effect of commercial preservatives
<table>
<thead>
<tr>
<th>E number</th>
<th>Chemical Compound</th>
<th>Comment</th>
<th>Production Issues</th>
<th>Canada</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>E201-203</td>
<td>benzoic acid, sodium benzoate</td>
<td>used in acidic foods such as jams, salad dressing, juices, pickles, carbonated drinks</td>
<td>ineffective, requires low pH &lt; 5</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>E270</td>
<td>lactic acid</td>
<td>used as a food preservative, curing agent and flavoring agent</td>
<td>Reacts with leavening, must be encapsulated</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>E280 – 283</td>
<td>propionic acid and calcium and sodium propionate</td>
<td>baked goods</td>
<td>Calcium most common form</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>E200 – 203</td>
<td>sorbic acid, potassium or sodium sorbate</td>
<td>common for cheese, wine, chemical leavened baked goods</td>
<td>Sorbic acid helps lower pH, potassium sorbate highly soluble</td>
<td>2000 ppm</td>
<td>2000 ppm</td>
</tr>
<tr>
<td>E 297</td>
<td>fumaric acid</td>
<td>used in beverages and baking powders, substitute for tartaric acid and citric acid</td>
<td>Use &quot;hot water soluble&quot; slower solubility, protects leavening</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>E 330</td>
<td>citric acid</td>
<td>a natural* preservative/conservative which occurs naturally in citrus fruits and is also used to add an acidic or sour taste to foods and drinks</td>
<td>Reacts with leavening, must be encapsulated. Label friendly</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>E 296</td>
<td>malic acid</td>
<td>generally used in beverages, bakery and candy It is generally used as a substitute for fumaric acid and occasionally in place of citric acid</td>
<td>Reacts with leavening, must be encapsulated</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>
Antimicrobials

Disrupts cell membrane function (mold, certain type of bacteria)
✓ Propionic acid

Disrupts cell membrane function/inhibits enzymes/inhibits bacterial spore germination (yeasts, molds, certain type of bacteria).
✓ Sorbic acid

Disrupts cell membrane function (bacteria, yeasts, some mold)
✓ Acetic acid,
✓ Benzoic acid

Inhibits enzymes/ disrupts cell membrane function (bacteria, primarily Clostridium botulinum)
✓ Nitrates
Acidulates

- Citric acid
- Malic acid
- Fumaric acid
- Vinegar / acetic acid
Shelf life dependency on acid

✓ pH < 5.5 gives > 21 days
✓ pH 6 gives 7 to 14 days
✓ pH 7 gives < 7 days

✓ As pH decreases (becomes more acidic) shelf life increases
✓ pH 4.8 – 5.5 is the optimal spot for extending product shelf life
Solubility rates of ingredients that contribute to the final pH

-Same pH of samples of tortilla

-Sprayed with a solution of Bromocresol Purple

-Low pH (yellow spots) of acid that did not completely dissolve in the tortilla.

-High pH (blue spots) of sodium bicarbonate that did not completely dissolve
Modified Atmosphere Packing- MAP

✓ Modified Atmosphere Packing (MAP) is long established and continuously increasing technique for extending the shelf-life of food.

✓ MAP requires specialized machinery to flush out air from the packing and replace it with a different gas or gas mixture.

✓ The MAP packing to provide longer shelf life, maintains sensory attributes like color or appearance and achieve the food safety of the product.

✓ The normal composition of air is 21% oxygen, 76% nitrogen and less than 0.1% carbon dioxide.

✓ Reducing the oxygen content while increasing the level of carbon dioxide and/or nitrogen has been shown to significantly extend the shelf-life at cold temperature of storage.
Machines used in MAP

Thermo-Forming machines
Mainly used plastic foils are polyethylene (PE), polyamide (naylons), polyethylenetetraphthalate (PET), polyvinilchloride (PVC), ethylene vinyl alcohol (EVOH) and polyvinylidene chloride (PVdC).

The packing material should be hold properties like: ease of manufacturing, clarity, heat sealing and strength.
Advantage of MAP

- Longer shelf life
- Reduces the growth of mold
- Retained taste, vitamin and fat content
- The natural color is preserved
Limitation of modified atmospheres

✓ High complexity

Possible failures include: incorrect gas composition, leaks due to faulty temperature or pressure distribution, seal contamination or defective material.

✓ Cost

Packaging films, consumption of gas and the personnel costs.

✓ Influence on product quality

Excessively high concentration of CO2 can be absorbed by the tortilla and make it sour. High oxygen concentration, problem with mold and change color of tortilla (tomato, spinach).
testing MAP

- Quality control of modified atmosphere food packaging (MAP) with the oxygen / CO₂ hand held gas analyzer for analysis of modified atmospheres in food packages (MAP).

- Monitoring of sample for time of shelf life.

- Check sealing on the bag by red test indicators
Conclusion

Ways to extend shelf life and maintain the quality of tortilla:

✓ GMP (high level hygiene in production)

✓ Reduce ambient airflow

✓ Increase preservative level

✓ Proper formulation and choosing ingredients

✓ Decrease water activity tortilla 0.95-0.98

✓ Optimal pH, decrease pH, add more acid

✓ Minimize cooling / packing contamination
Conclusion

Ways to extend shelf life and maintain the quality of tortilla:

✓ MAP packaging

✓ Proper packaging material

✓ Decrease tortilla storage temperatures