Achieving Affordable Shelf-Storable OFSP Pyrée without refrigeration

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SWEETPOTATO ACTION FOR SECURITY AND HEALTH IN AFRIC

Purée



 A purée (or mash) is cooked food, usually vegetables or legumes, that has been ground, pressed, blended or sieved to the consistency of a soft creamy paste or thick liquid.



Making the Purée





- OFSP roots graded and washed
- OFSP roots peeled to remove skin
- OFSP roots cut into cubes
- OFSP roots steamed
- OFSP roots pureed

Case Study: Independent OFSP Puree Processing: Partnership-Business Model Kenya





Case Study: Rwanda (Onsite OFSP Puree Production and Utilization)











Challenges

• OFSP puree is perishable



- Perishable OFSP puree requires instant utilization
- Perishable OFSP puree requires a cold chain for transport and storage
- In SSA cold chain is unsustainable electricity unreliable and very expensive
- A shelf-stable OFSP puree would expand the benefits and utilization of puree in SSA

OFSP Purée Challenge



- Food spoilage: disagreeable change in a food's normal state. Such changes can be detected by smell, taste, touch, or sight.
- These changes are due to air, oxygen, moisture, light, microbial growth, and temperature.

Developing Shelf-Stable OFSP Purée



- Microbial spoilage of any particular food will be by those organisms most suited to the conditions in and around that food. (Bacterial, Virus, Fungi/yeast and Molds).
- Non microbial spoilage -food may spoil as a result of chemical changes within the food itself or by a reaction between the food and the packaging material

Developing Shelf-Stable OFSP Purée

- OFSP puree demand for bakery application
- **OFSP production is seasonal** in east, central and southern Africa
- Shelf-Stable OFSP puree will bridge the supply gap for all year OFSP puree bread availability
- Shelf-stable puree access by small-bakers in rural and remote areas

Control of microbial spoilage



- The micro-organism can grow at temperatures between -7 to around 70°C
- Over a pH range from 0 to 11
- In the presence or absence of oxygen
- At water activities above about 0.6

The Hurdle Principe of Food Preservation



- The microbial stability and safety of most traditional and novel foods is based on a combination of several factors (hurdles), which should not be overcome by the microorganisms present.
- The hurdle effect is of fundamental importance for the preservation of foods, since the hurdles in a stable product control microbial spoilage, food-poisoning and, the desired fermentation process

The Hurdle Technology



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Shelf-Stable OFSP Purée



Nicin E234:

- Antibacterial
- Extend shelf life by suppressing Grampositive spoilage and pathogenic bacteria
- Vacuum packing

Natamycin E235:

- Antifungal
- Natamycin used in the food industry as a hurdle to fungal outgrowth in foods.
- Vacuum packing

CLEAN LABEL: Free of Artificial Food Additives and Chemical Preservative Free

Stop Spoilage





R &D OFSP Puree

Clean Label



Clean Label

- Traditional chemical preservatives replacement
- Neutral flavor impact
- Less dependence on pH for efficacy
- Together with vacuum packing extends OFSP puree shelf-life by 2-4 months.
- Expensive \$.40/kg



Chemical Preservatives



Sodium Benzoate E:211

- It is bacteriostatic and fungistatic under acidic conditions.
- Concentration as a food preservative is limited by the FDA in the U.S. to 0.1% by weight
- Generally Recognized As Safe (GRAS) by the FDA.

Potassium Sorbate

- Used to inhibit molds and yeasts in many foods
- Typical culinary usage rates of potassium sorbate are 0.025% to 0.1%
- GRAS designated by FDA

Effect of storage conditions on OFSP puree shelf life

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Total Viable Counts in OFSP Puree treated with preservative

SASHA Sweetpotato Action for



Treatment by Packaging

Messy Blow ups





Ensure Food Safety





 An acidified food (AF) is a low-acid food to which acid(s) or acid food(s) are added and which has a finished equilibrium pH of 4.6 or below and a water activity (aw) greater than 0.85.

Acidified OFSP Puree Experimental Design



- OFSP Puree Vita and Kabode
- Preservatives Sorbate, benzoate & citrate
- Packaging

vacuum packing

- Storage conditions
- Follow up time
- Analysis: and Nutritional

15-24°C 24 Weeks Food safety (TVC)

OFSP Puree Storage Trials





OFSP Puree Processing for Storage Trials at Organi Limited Ringa Homa Bay County

OFSP Puree Storage Trials

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Treatment	Potassium Sorbate	Sodium Benzoate	Citric Acid	Vacuum Packing
1	0.10%	0.10%	1%	Yes
2	0.25%	0.25%	1%	Yes
Control 1	0.50%	0.50%	1%	Yes
Control 2	0	0	0	Yes

OFSP Puree Storage Trials





Treating OFSP Puree With Chemical Preservatives, Vacuum Packing and Storage

Study Design



Treatment 1:

1% sorbate+1% benzoate+1% citric acid + vacuum packing **Treatment 2**:

0.5% sorbate+0.5% benzoate+1% citric acid+ vacuum packing **Treatment 3**:

0.25% sorbate+0.25% benzoate+ 1% citric acid +vacuum packing

Treatment 4:

0.1% sorbate + 0.1% benzoate+1% citric acid + vacuum packing **Treatment 5**:

No preservative +vacuum packing

1% citric acid reduces puree pH from 5.5 to 4.2, increases efficacy of preservatives NB: All treatments with preservatives extended the puree shelf-life by 3-4 months

The winner and preferred combinations



- Potassium sorbate 0.25%
- Sodium benzoate 0.25%
- Citric acid 1% (pH =4.2)
- Vacuum packing
- Shelf-life 3- 4 months at 15-24 C



CHALLENGES

Effects of Sorbate and Benzoate



- Sorbates retard yeast activity and extend fermentation
- Proofing times of yeast leavened products.
- The bread volume is significantly lowered
- Citric acid taste



Shelf-Stable OFSP Puree Bread Trials





OFSP Shelf-Stable Puree Bread Trials





OFSP Shelf-Stable Puree Bread Trials



Approach

- Reduce OFSP puree in bread from 45 to 30%
- Increase the amount of yeast from 1 to 2%
- Increase the amount of baking powder from 0.1 to 1%
- Add 0.5% baking soda to reduce acidity
- Try combinations of the above factors
- Cost the recipes

Shelf-Stable OFSP Puree Bread Trials



	OFSP Fresh Puree Bread	Shelf-Stable OFSP Puree Bread	Standard White Bread
Ingredient	Quantity (g)	Quantity (g)	Quantity (g)
Wheat Flour	23000	22848	40250
OFSP Puree	17250	19200	
Sugar	430	480	1800
Salt	430	288	450
Yeast	450	720	280
Bread improver	200	240	100
Fat	1200	960	1800
Functional gluten	300	240	
Baking Powder	0	240	
Baking soda	0	120	

The Future



- Current Shelf stable puree application limited the bakery applications, we can adopt and develop technologies to have shelf-stable OFSP puree with unlimited use.
- We want technology to develop a shelf stable OFSP puree with 12-24 months shelf-life with potential to unlock multiple puree utilization and attract commercial/industrial users

THE END





