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FINAL CONGRESS OF FREEZWEWAVE PROJECT

5th November 2018

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- Objectives
- Methods & Material
- Results
- Conclusion

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GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Freezewave

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OBJECTIVES

Freezewave

The tests were carried out to investigate the impact of microwave assisted freezing on sensory quality of selected products.

1. Fresh products have the best sensory quality as compared to frozen products.
2. Products treated with microwave-assisted freezing should have better sensory properties as products treated with static freezing.
3. Products treated with microwave-assisted freezing should have sensory properties similar to products treated with fast freezing, but with a lower energy consumption.

As reference samples potatoes (vegetable), fish (cod) and chicken breast (meat) were selected.

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METHODS & MATERIAL

Freezewave

- Methods

Simple sensory description DIN 10964
↓
Ranking test DIN ISO 8587
↓
Intensity measurements DIN 10966

- Material
  - Microwave assisted freezing (Microwave Freezing - **MF**)
  - Fast Freezing (Fast Freezing - **FF**)
  - Conventional Freezing (Static Freezing - **SF**)
  - Fresh sample (Fresh - **FR**)

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MATERIAL - PANELISTS

- Selected in February 2018 through selection tests according to DIN EN ISO 8586
  - 4 men
  - 8 women
  - Age: 20-63 years
- Trained in March 2018 to sensory methods, working in a sensory panel and to sensory characteristics of potatoes
- April: Fish
- May: chicken breast filet

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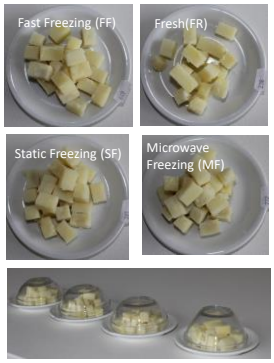
POTATOES

Freezewave

- Potatoes were delivered by ONIRIS to ttz
  - Fresh samples (FR)
  - Frozen samples (FF, SF, MF)
- Preparation
  - Frozen samples were thawed in water (20°C) for 10 minutes
  - Cooked for 2 minutes
  - Fresh samples were cooked for 8 minutes



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POTATOES

Freezewave

Descriptions	F-value	Chi-quadrat 5%	Chi-quadrat 1%
Odour intensity	6,4		
earthy	12,8		X
pea	3,2		
bean	9,1	X	
root	4,7		
yellow	40		X
smooth	19,4		X
shiny	20,1		X
mealy	23,4		X
Taste intensity	27,6		X
sweet	3,5		
bitter	6,6		
salty	9,2	X	
butter	13,3		X
earthy	5,3		
mealy	17,7		X
soggy	5,4		
gritty	5,8		

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Calculated by Friedman-Test; critical F-value 7,81 (5%); critical F-value 11,34 (1%)

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POTATOES

Freezewave

	Low High intense			intense
Earthy odour	SF - A	MW -A	FF - AB	FR - B
Beany odour	FF - A	MW - AB	SF - AB	FR - B
Yellow colour	FF - A	MW -A	SF - A	FR - B
Smooth appearance	FR - A	FF - B	MW - B	SF - B
Shiny appearance	FR - A	FF - AB	MW - B	SF - B
Mealy appearance	SF - A	MW - AB	FF - BC	FR - C
Taste intensity	SF - A	MW - A	FF - A	FR -B
Salty taste	MW - A	SF - A	FF - A	FR - B
Butter taste	SF - A	FF - A	MW - AB	FR - B
Mealy texture	SF - A	MW - A	FF - A	FR - B

Multiple Pairewise comparison by Nemenyis procedure

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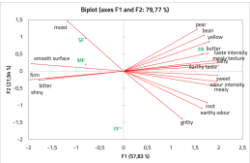
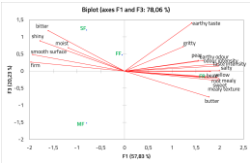
POTATOES – GENERALISED PROCRUSTES ANALYSIS (GPA)

Freezewave





Overview on attributes and products correlated to the three factors

	Factor 1 57,83%	Factor 2 21,94	Factor 3 (20,23%)
Descriptors	odour intensity, earthy odour, pea, bean, root, yellow colour, mealy appearance, taste intensity, sweet	moist	Shiny, bitter, earthy taste

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POTATOES SUMMARY

Freezewave

- most of the significances can be found between the fresh and the frozen samples.
- In most of the attributes of the appearance, smell, taste and texture, the fresh potatoes are significantly different to the frozen samples.
  - retrogradation of the starch inside of the potatoes (appearance, texture)
  - Damage of cell structure (taste, smell)
- There is no clear tendency for one technology to be better or worse.

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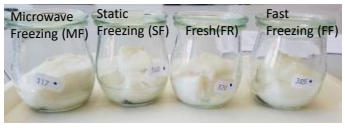
Freezewave

FISH

- Frozen samples
- thawed for 24 h at 4 °C,
- fresh sample was delivered by a local fish producer the day before and was stored under the same condition at 4°C on ice Cooking of the samples
- Heating at low energy (240W) for 12 minutes



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FISH

Freezewave

descriptions	F-value	Chi-quadrat 5%
odour intensity	1,3	
prickling odour	1,6	
fresh sea	3,6	
mouldy	**8,3**	**x**
butter	1,0	
sourly	2,4	
colour	0,8	
nacroid colour	2,5	
shiny	5,9	
protein outfall	**9,1**	**x**
taste intensity	-2,5	
sweet	5,2	
sour	6,1	
salty	3,4	
bitter	3,0	
umami	5,5	
butter taste	**8,7**	**x**
metallic	2,7	
firm texture	2,3	
fibrous	2,3	
chewy	2,5	
juicy	3,0	

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Calculated by Friedman-Test; critical F-value 7,81 (5%); critical F-value 11,34 (1%)

FISH

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Freezewave

	Low High intense			intense
Mouldy	FR - A	SF - AB	FF - AB	MW - B
Protein outfall	SF - A	FR - AB	MW - AB	FF - B
Butter taste	SF - A	FF - AB	FR - AB	MW - B

13 Multiple Pairewise comparison by Nemenyis procedure

FISH – GENERALISED PROCRUSTES ANALYSIS (GPA)

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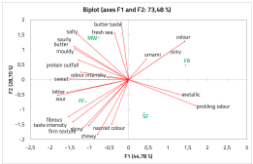
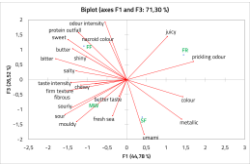
Freezewave





Overview on attributes and products correlated to the three factors

	Factor 1 (44,78%)	Factor 2 (28,70%)	Factor 3 (26,52%)
Descriptions	Prickling odour, colour, metallic taste	Fresh sea, salty, butter	Odour intensity, nacroid colour, sweet and juicy
samples	FR, SF	MW	FF

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FISH SUMMARY

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- The panel perceived only differences 4 attributes
  - mouldy smell, protein outfall and butter taste.
  - Protein outfall an interesting attribute (possible cell damages)
    - no differences between MW and FR and SF, but between SF and FF.
- The perceived differences between the samples are limited and no differences are perceived between MW and the fresh sample.

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CHICKEN BREAST FILET

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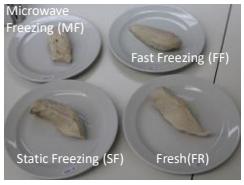
Freezewave

- Frozen samples
  - thawed for 24 h at 4 °C
- Preparation of the fresh sample
  - taken out of the packaging and weight
  - After that out parts were removed of the filet in order to have a final weight of 100 g.
- Cooking of the samples
  - proportion of water to chicken was
  - cooked for 8 minutes



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CHICKEN BREAST

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Freezewave

descriptions	F-value	Chi-quadrat 5%	Chi-quadrat 1%
odour intensity	2,16		
sourly	1,8		
sweet	1,72		
metallic	1		
butter	4,12		
protein odour	0,52		
colour	5,4		
protein outfall	0,92		
fibrous	5,2		
shiny	1,72		
taste intensity	**11,28**	x	
sweet	6,16		
sour	0,4		
salty	1,32		
bitter	4,44		
umami	2,68		
metallic	3,16		
dry	**18,12**		x
fibrous	**13,96**		x
soft	**21,96**		x
fatty	-2,22		
elastic	4,76		

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Calculated by Friedman-Test; critical F-value 7,81 (5%); critical F-value 11,34 (1%)

CHICKEN BREAST

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Freezewave

	Low High intense			intense
Taste intensity	FF (A)	SF (A)	MW (AB)	FR (B)
dry	FR (A)	SF (AB)	FF (B)	MW (B)
fibrous	FR (A)	SF (AB)	FF (AB)	MW (B)
soft	MW (A)	FF (AB)	SF (BC)	FR (C)

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CHICKEN BREAST – GENERALISED PROCRUSTES ANALYSIS (GPA)

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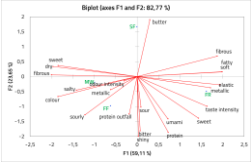
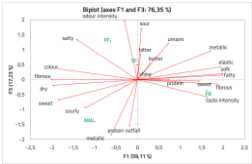
Freezewave





Overview on attributes and products correlated to the three factors

	Factor 1 (59,12%)	Factor 2 (23,65%)	Factor 3 (17,23%)
Descriptions	Taste intensity, soft, elastic, fatty	butter	Odour intensity, sour, salty

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CHICKEN BREAST SUMMARY

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- significant differences are found in the textural attributes
- Dry, fibrous and soft and in the attribute taste intensity.
  - MW is rated to be less soft, but much more fibrous and it can be concluded that for the chicken breast filet, MW has more impact on cell structure than in the fish or in the potatoes.
  - Interestingly, this assumption would imply that taste intensity is lower than for the other samples, but this is not the case.
- The taste intensity is similar to the fresh sample.

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SUMMARY & CONCLUSION

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Freezewave

- The panel detected
  - 10 significant differences for potatoes
  - 3 significant differences for the fish
  - 4 significant differences for the chicken breast filet
- Samples frozen with MW were not inferior to the other freezing technologies
- MW freezing could be an alternative ways of freezing products, especially when it comes to vegetable based products
  - Impact of freezing is higher than of the technology
- low energy cost technology

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