Brined pork meat characterization using Fluorescence spectroscopy

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Context and objective

Salt treatments in meat

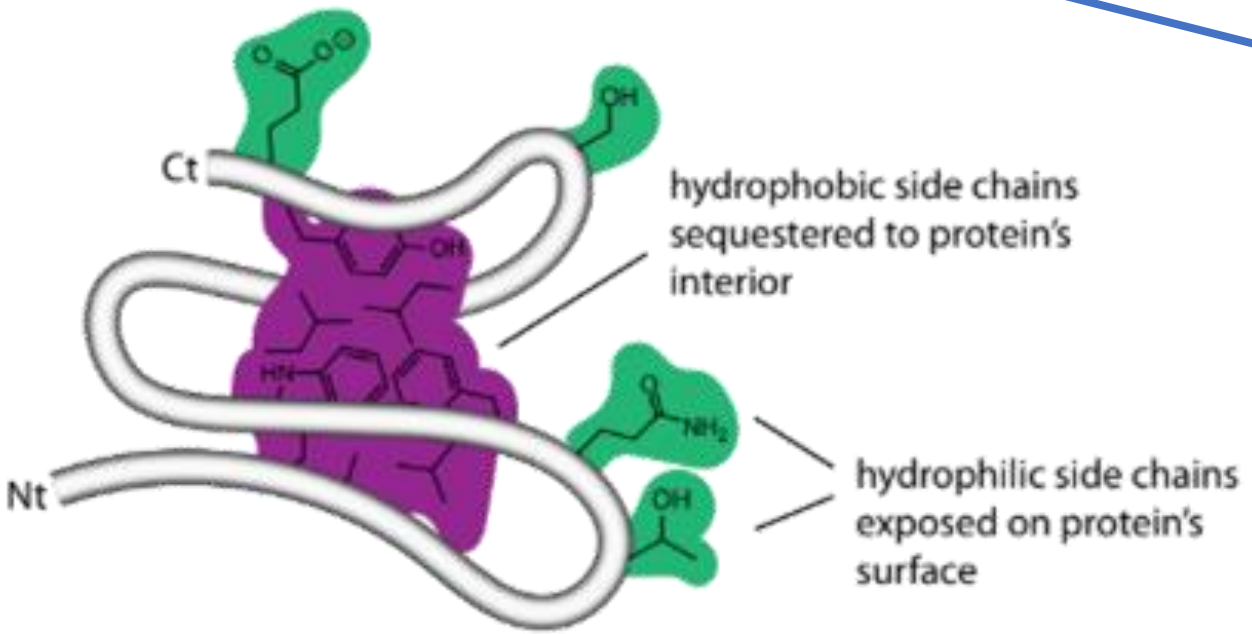
Improve preservation

Improve juciness and texture

Salt → Change proteins conformation

Context and objective

Muscle proteins → Tryptophan , Tyrosine, Phenylalanine → Hydrophobic interactions inside the protein → Stabilization of protein structure



Protein denaturation → Trp external face of protein

Context and objective

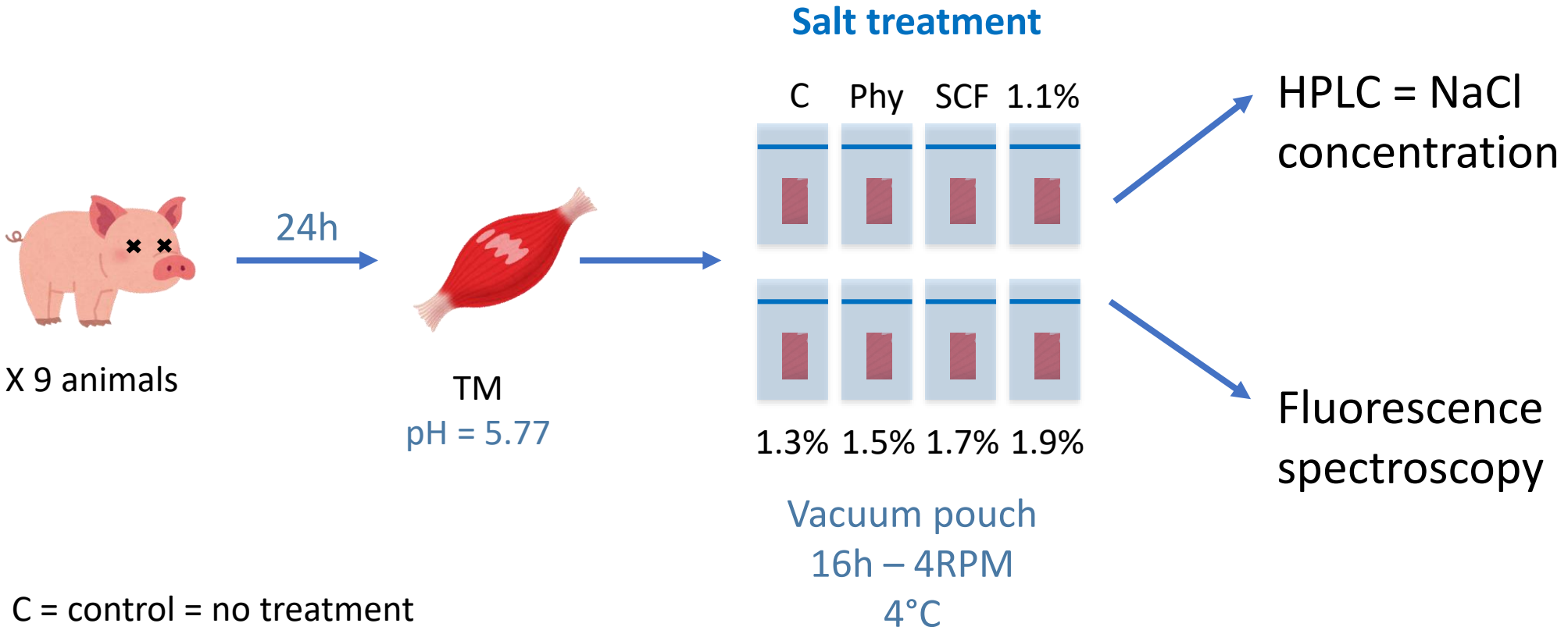
Hypothesis:

Variations in Trp fluorescence are linked to salt concentration

Objective: Better understanding of the impact of salt concentration on protein denaturation for a better control in industry

Study the impact of NaCl concentrations on Trp fluo in pork meat

Study design



C = control = no treatment

Phy = 0.9 % NaCl

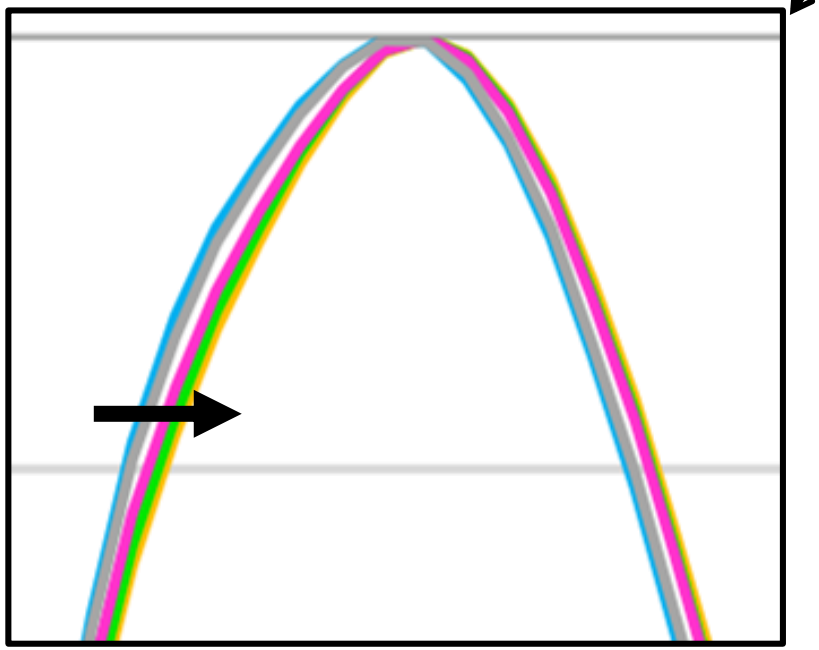
SCF = Sodium Chloride Free = No NaCl but 0.05% of Sodium ascorbate → Prevent lipid oxidation

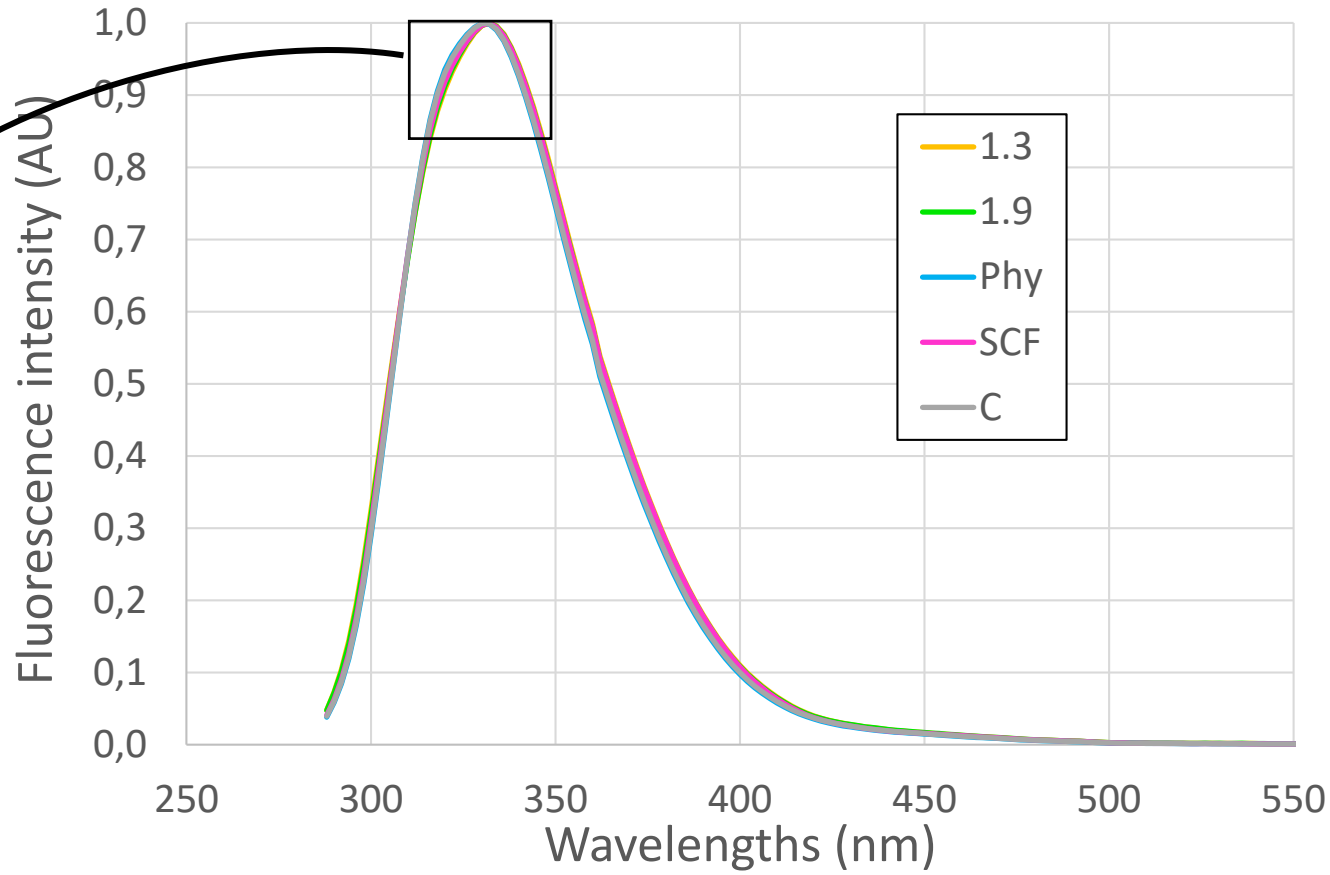
All treatments with NaCl have also 0.05% of Sodium ascorbate

Results

Fluorescence results:

Mean spectra all animals

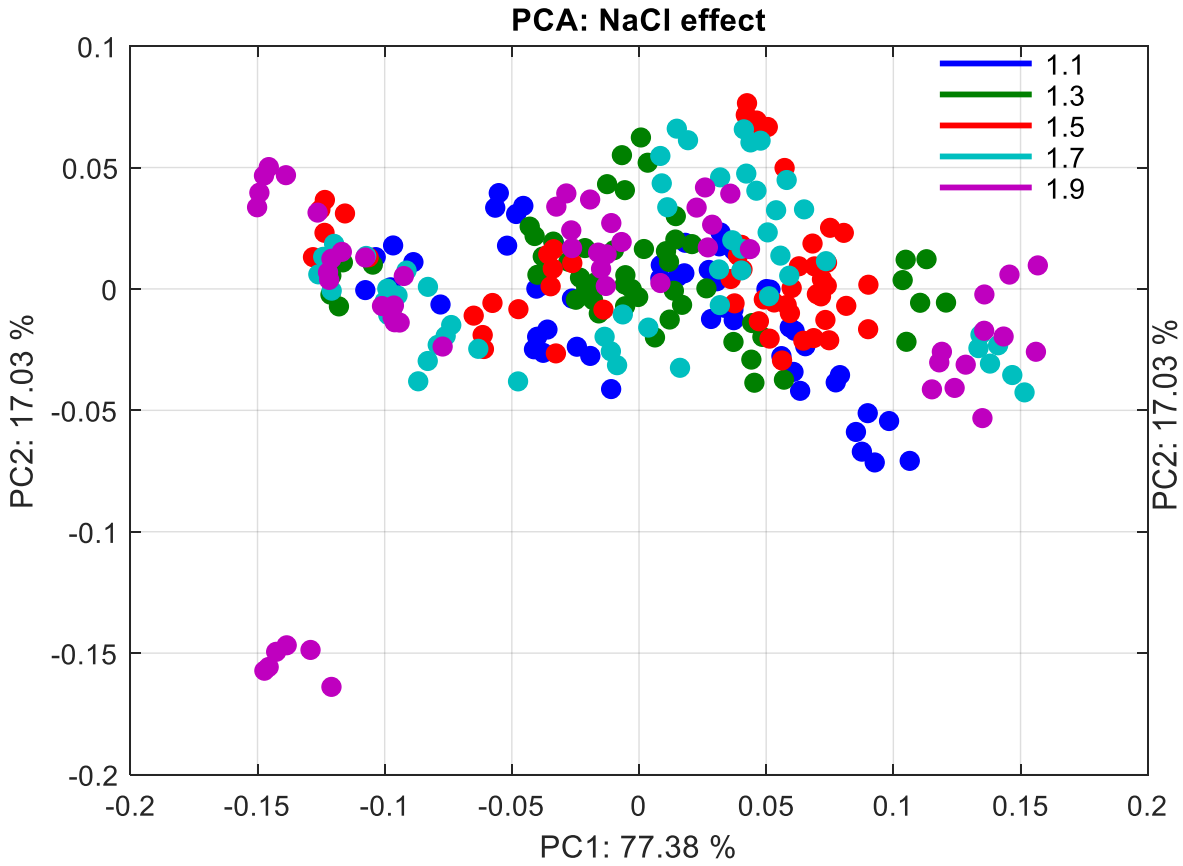


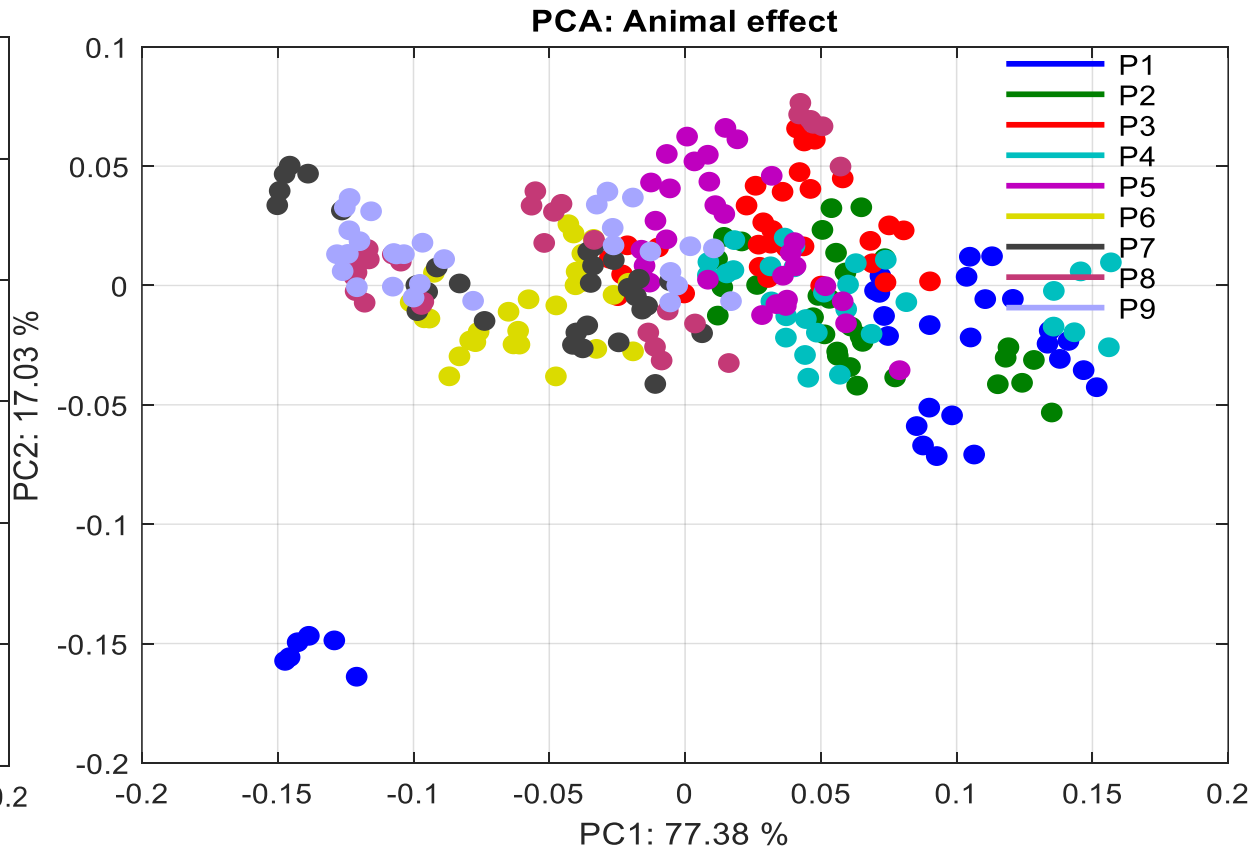


- **Red shift** with salts (both NaCl and Sodium Ascorbate)
- The shape of the peak is different with salt

Results

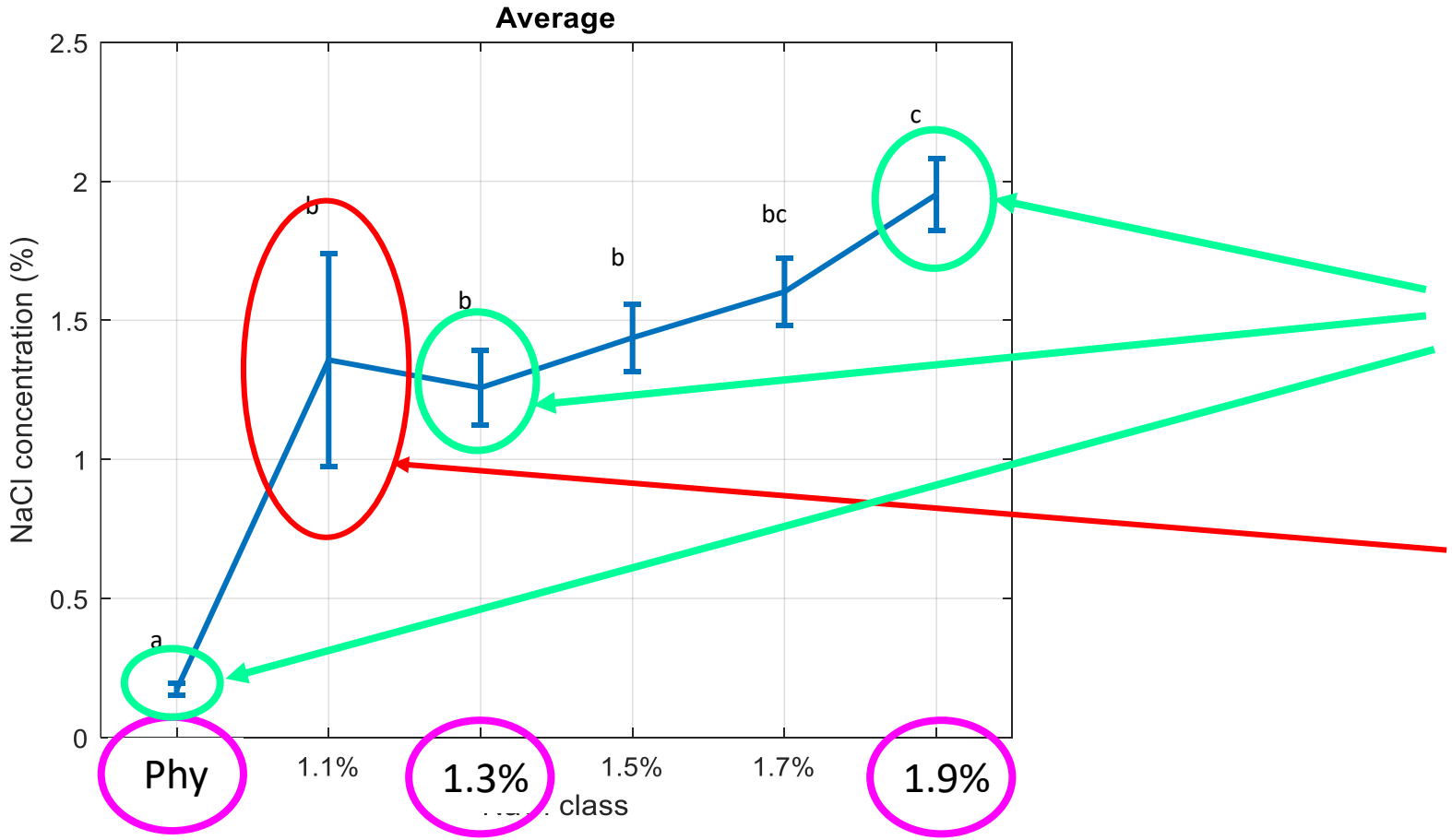
PCA: All animals together = no separation





Results

Measurement of NaCl concentration in samples with HPLC:



Low variability
+ significant difference between concentrations

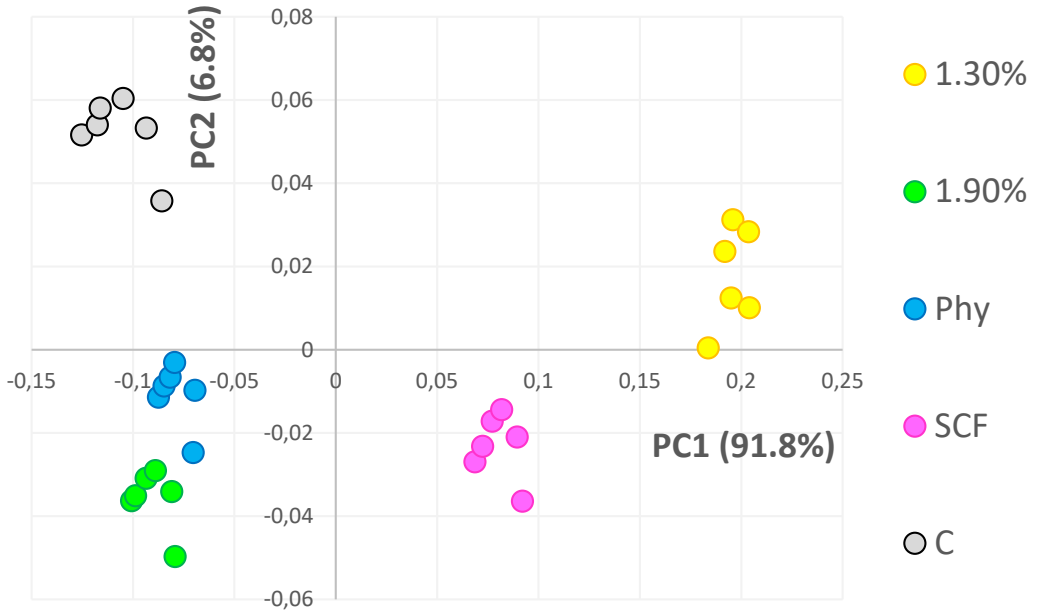
High variability

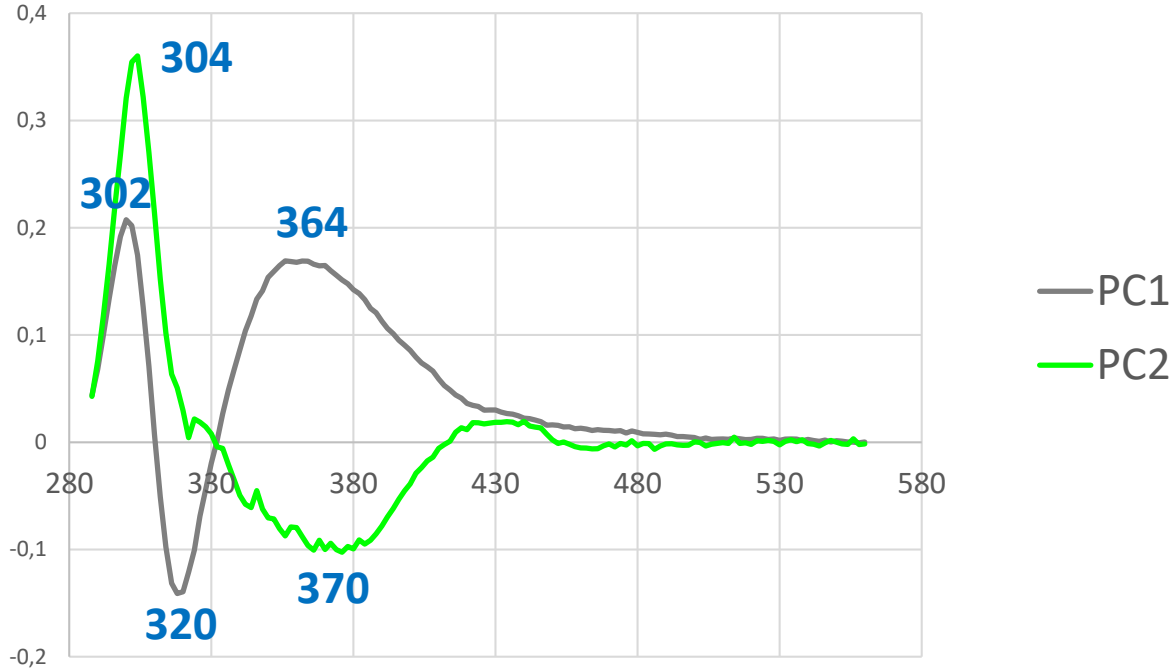
Results

- Analysis animal per animal
- PCA on Control samples, SCF, Phy, 1.3%, 1.9% to identify the relevant wavelengths that better separate the samples
- ANOVA + Tukey Test to check the significance of the difference between the samples

Results

PCA results, example on animal 1 :





- C → more fluo around 300 and 320 nm
- SCF → more fluo around 364-370 nm
- 1.3% → more fluo around 300 and 364 nm
- Phy and 1.9% → more fluo at 320 and 370 nm

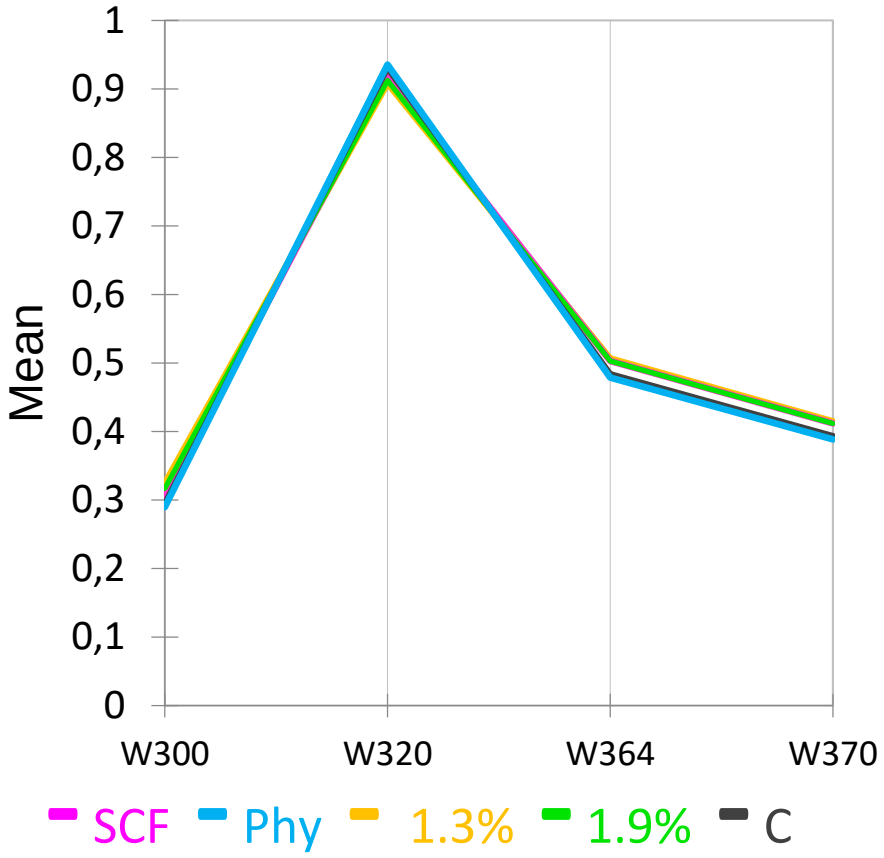
Red shift observed with salts

Check with ANOVA at 300, 320, 364 and 370 nm

Results

ANOVA results:

Samples groups	300 nm	320 nm	364 nm	370 nm
Control	**0,295 d**	**0,931 a**	**0,484 b**	**0,393 b**
Phy	**0,290 d**	**0,935 a**	**0,479 b**	**0,389 b**
SCF	0,305 c	0,919 b	0,503 a	0,412 a
1.3 %	0,325 a	0,908 c	0,507 a	0,415 a
1.9 %	0,317 b	0,912 c	0,503 a	0,412 a

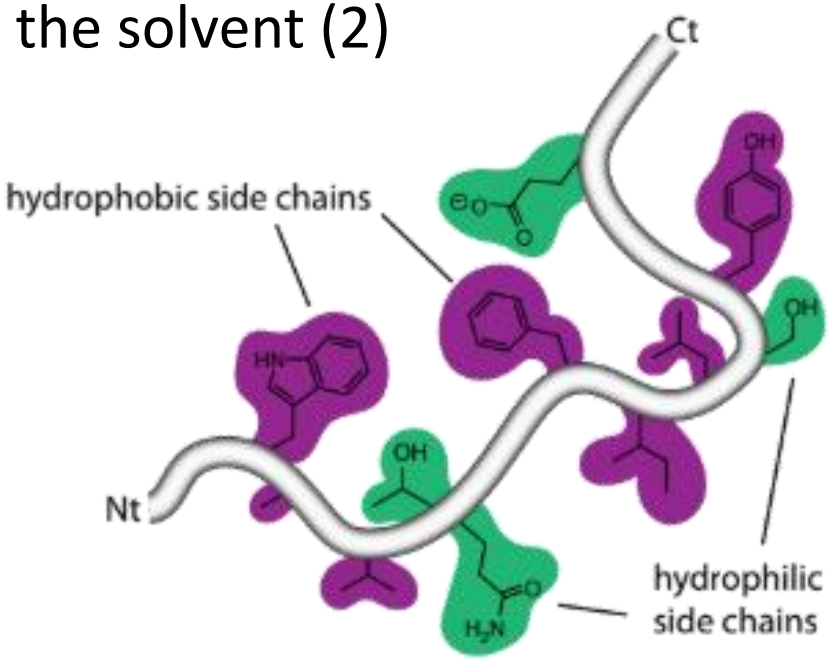


Confirmation of a significant red shift with salts

Results

In literature:

- Salt in pork myofibrillar tissue ⟹ shrinking of α-helice (1)
- Red shift of the tryptophan peak = tryptophan fully exposed to the solvent (2)



1 (Böcker et al., 2006) ; **2** (Vivian & Callis, 2001)

Conclusion and perspectives

In summary:

- Phy and Control samples had a similar fluorescence response
- The addition of 0.05 % of sodium ascorbate and NaCl solution induced a red shift of the trp peak
- This shift is caused by the partial denaturation of the proteins exposing Trp to the solvent
- But we could not distinguish the effect of salt concentration

Perspectives:

Further analyses in fluorescence micro-spectroscopy in Synchrotron are in progress → help understanding of salt concentration effect on Trp

Thank you !

*from **Quality of Animal Products Unit – INRAE** - France*

- 3D printing of meat products adapted to chewing disabilities
- Insects quality and entomoconversion
- Impact of processing on meat products structure and nutrients
- Modelisation and prediction
- New technologies to process meat products