

# A Role of Arginine as a Sodium Polyphosphate Replacement in Surimi Processing



Jae Park,  
Oregon State University

# Commercial Cryoprotectants in **Surimi**

## Cold water surimi

Cryoprotectants	%
Sugar	4
Sorbitol	4 – 5
Polyphosphate	0.3

## Tropical surimi

Cryoprotectants	%
Sugar	6
Polyphosphate	0.2

- ❑ Sweetness is about the same
- ❑ Sugar/Sorbitol – guarantees **longer frozen shelf life**

# Why are phosphates used in surimi?

## Neutralize the pH of washed meat

- Live fish
- Harvesting/Processing/Washing
- Screw press meat
- Sodium tripolyphosphate (STPP)
- Tetrasodium pyrophosphate (TSPP)
- A mixture (50/50) of STPP/TSPP
- At 0.2 - 0.3%, pH can be **7.2±0.2**

## Chelate divalent metal ions

- Metal ions denature proteins
- Ion conc. increases as  $H_2O \rightarrow$  Ice
- Some phosphates easily form metal compounds. “**Chelating**”

## Inhibit TMAOase

- Prevents crosslinkage during frozen storage

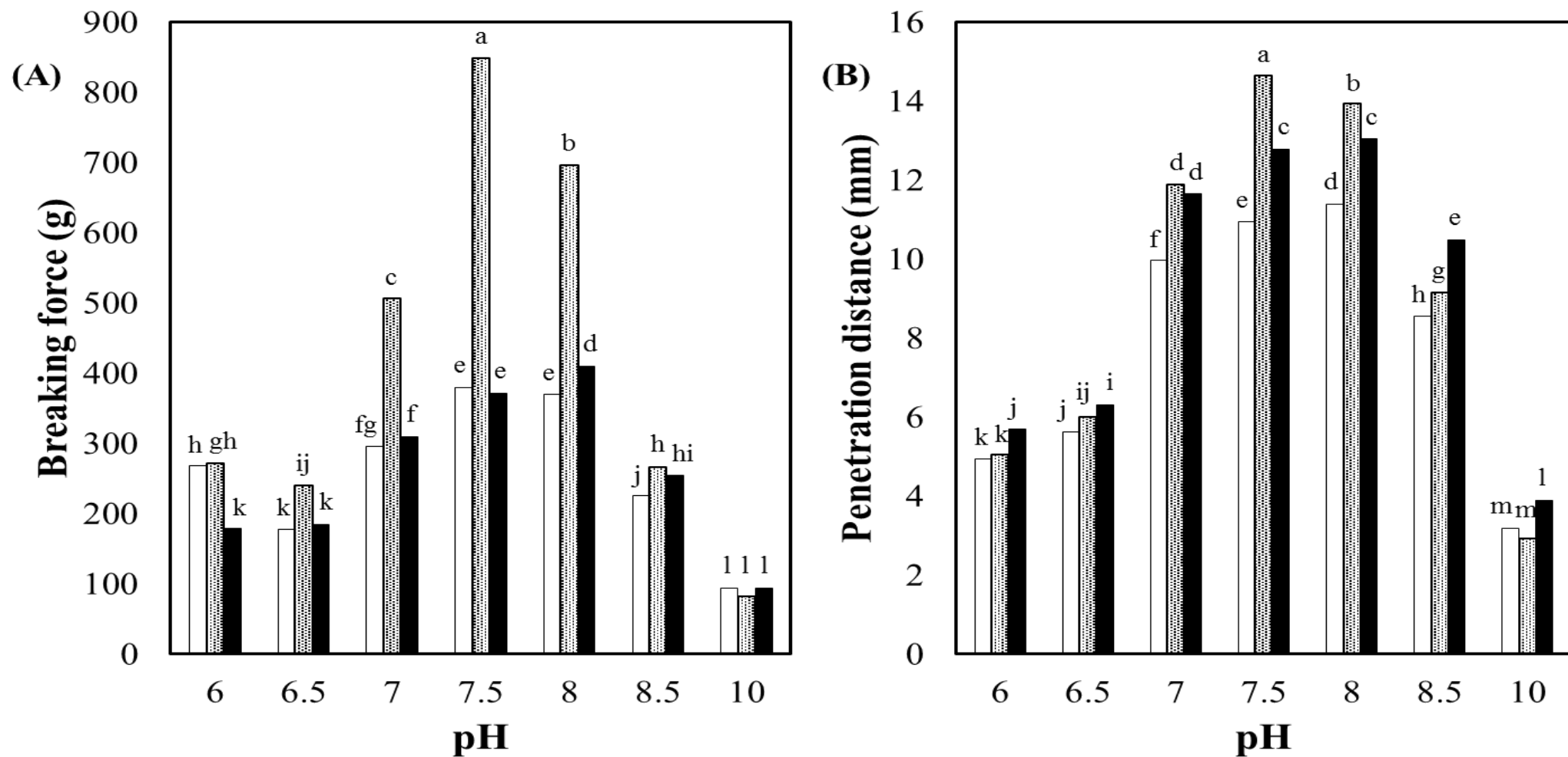


Figure 1. Breaking force (A) and penetration distance (B) of various pH/heating surimi gels. (□) WB1, heated at 90°C for 30 min; (▨) WB2, set at 25°C for 2 h followed by heating at 90 °C for 30 min; (■) OH, heated at 13.3 V/cm voltage gradient to 90°C in 30 sec. Different capital letters indicate significant differences (p<0.05).



# Sample preparation

- L-arginine (0.15% and 0.3%)
- A Mixture (50/50) of sodium tripolyphosphate (STPP) and tetrasodium pyrophosphate (TSPP): 0.3%
- Screw Press Meat of Pacific Whiting



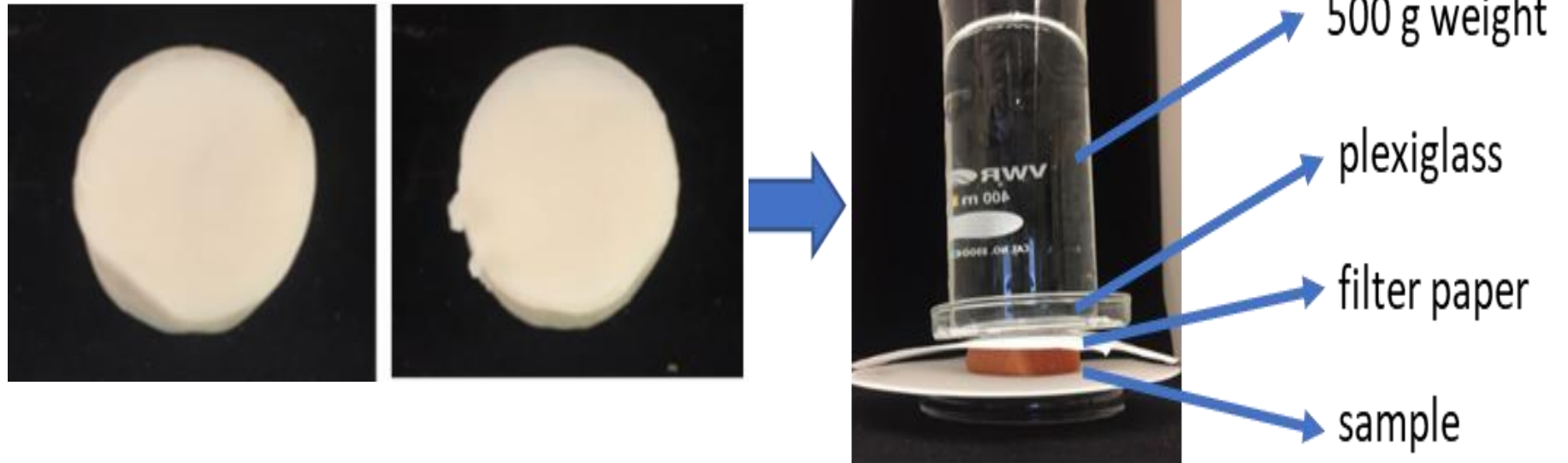
# Freezing and Thawing Cycles

- Screw press meat was mixed with testing ingredients
- 500 g blocks were made and **frozen at -20°C overnight**
- Blocks were subjected to **0, 3, and 9 cycles of Freeze and Thaw**



# Analysis

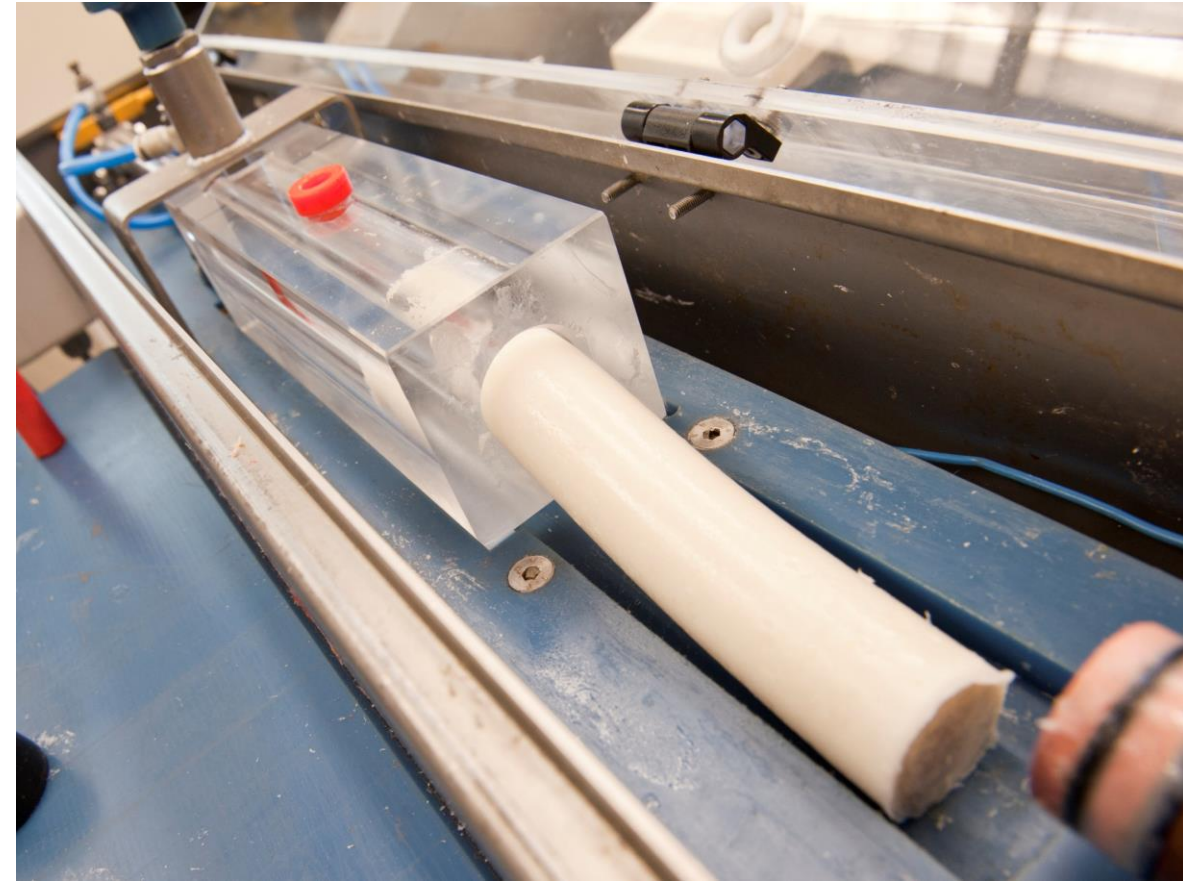
- **pH** – 10g in 190 dd H<sub>2</sub>O
- **Water Retention Ability** – Moisture loss to filter papers under 500 g weight.





# Analysis

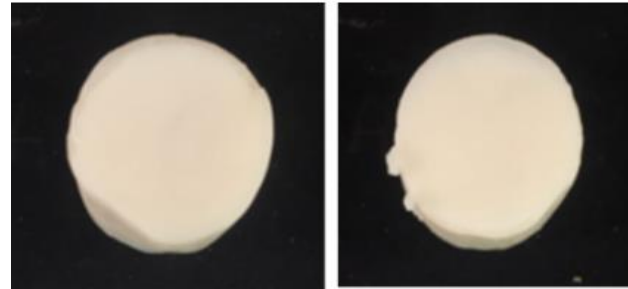
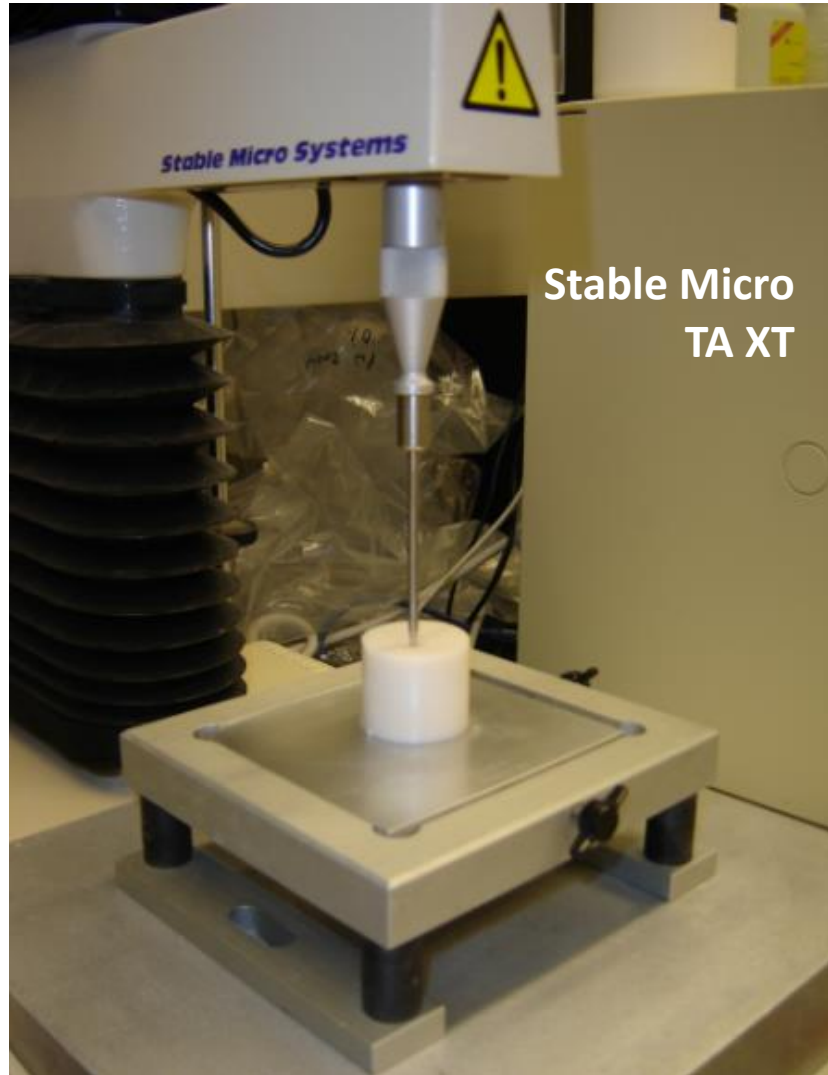
## Gel Texture and Color



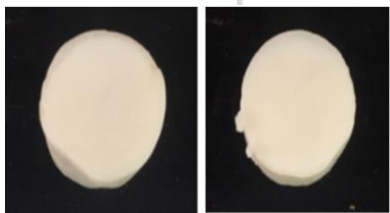
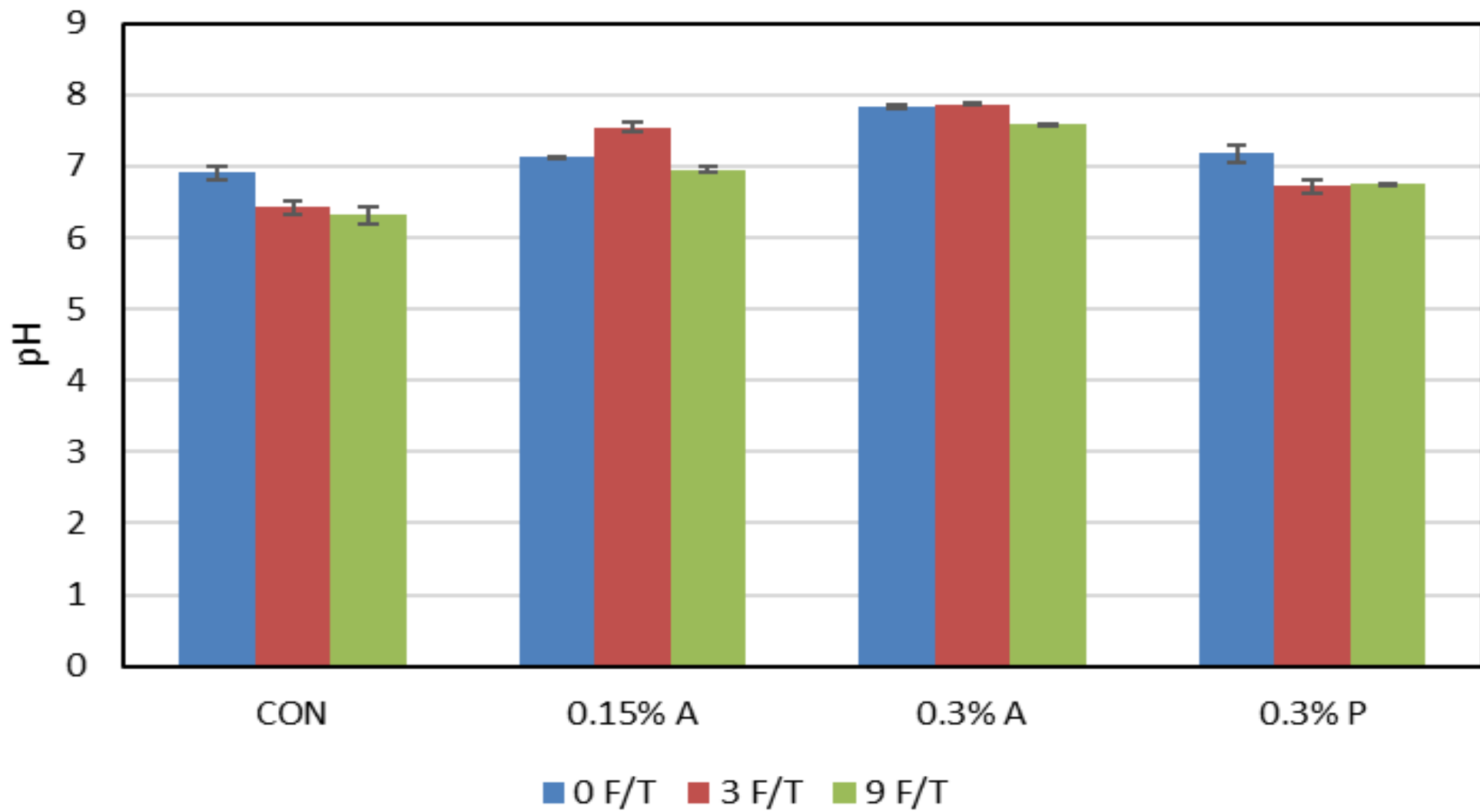
- 3% Salt was mixed with 97% Surimi before chopping using CODEX CODE for Frozen Surimi (Park, 2014).
- Stuffed in 3 cm cooking tube before cooking in RAPSA (ohmic cooker).

# Analysis

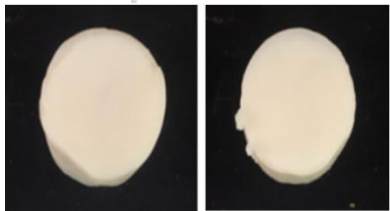
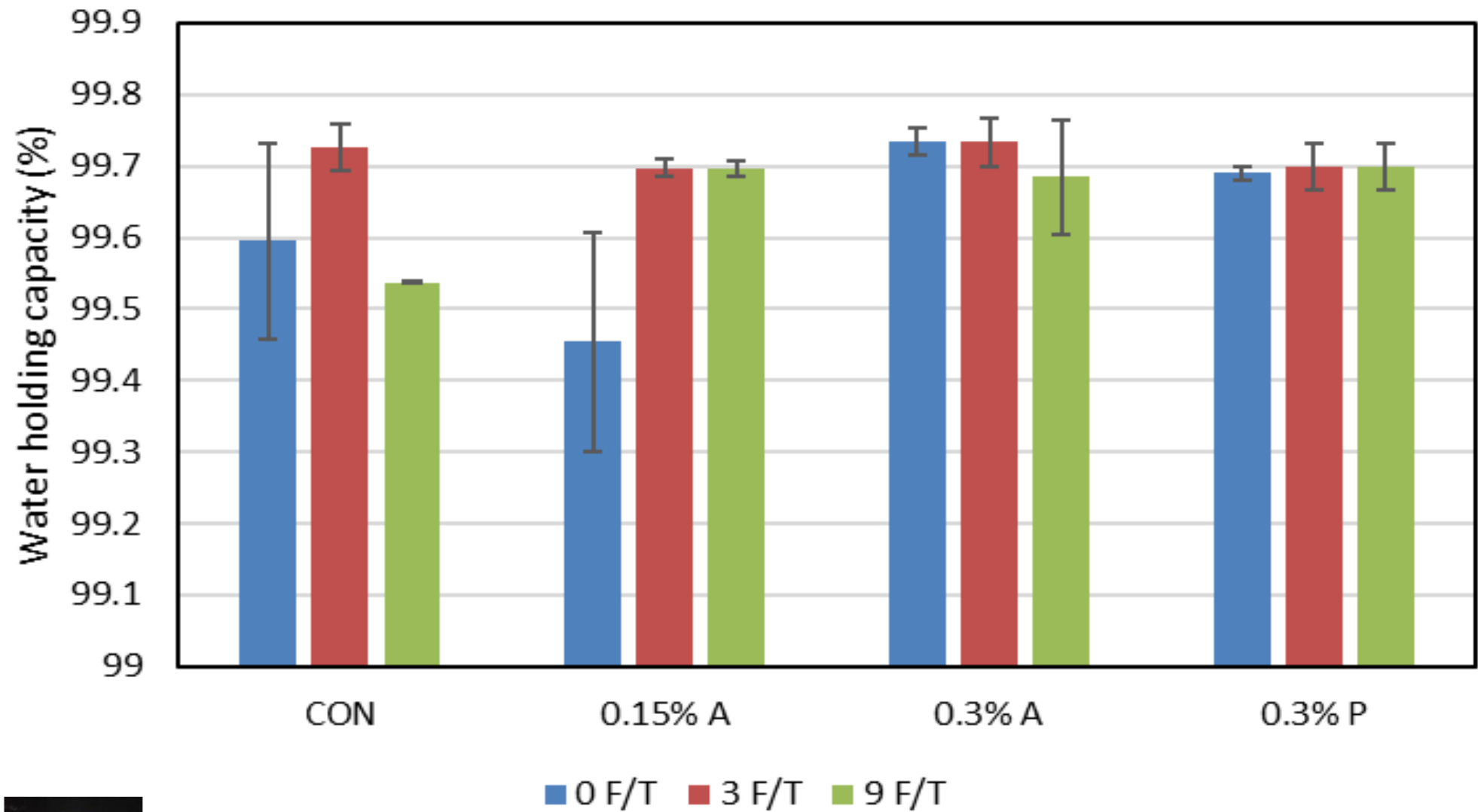
## Gel Texture and Color



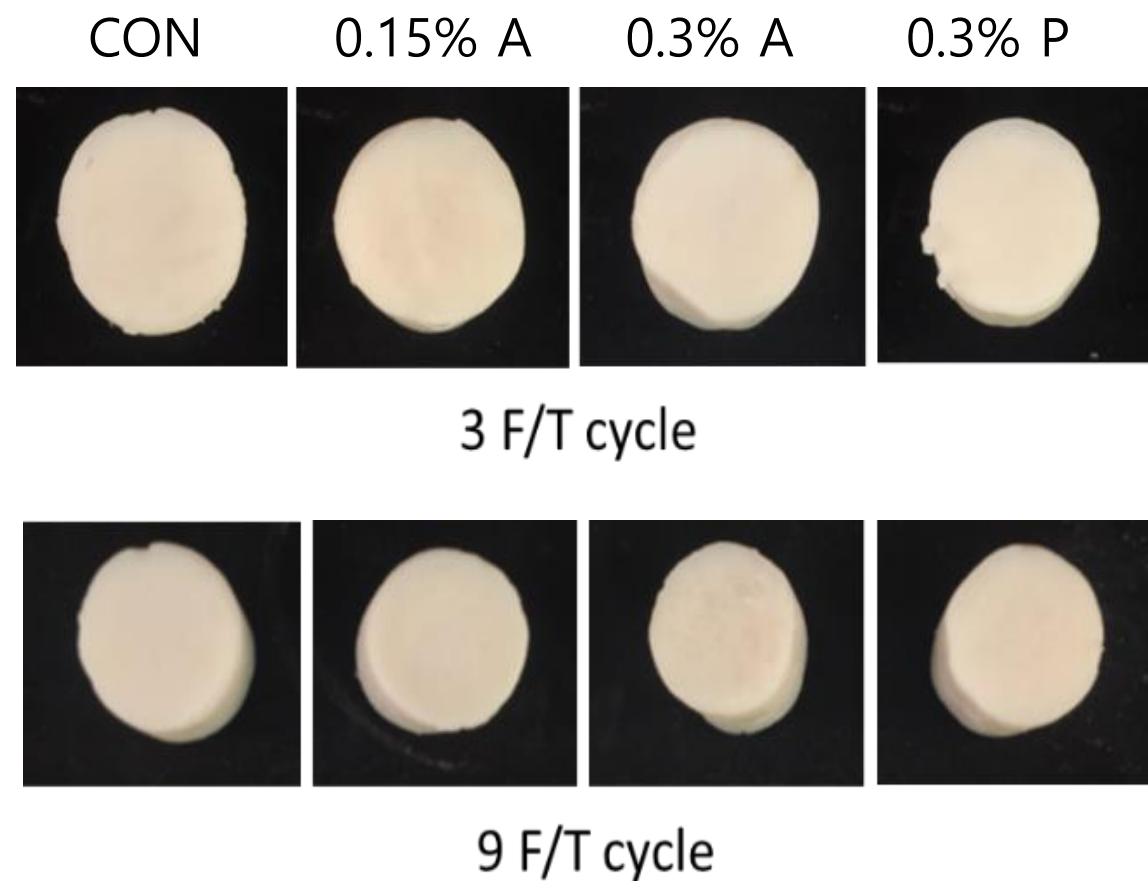
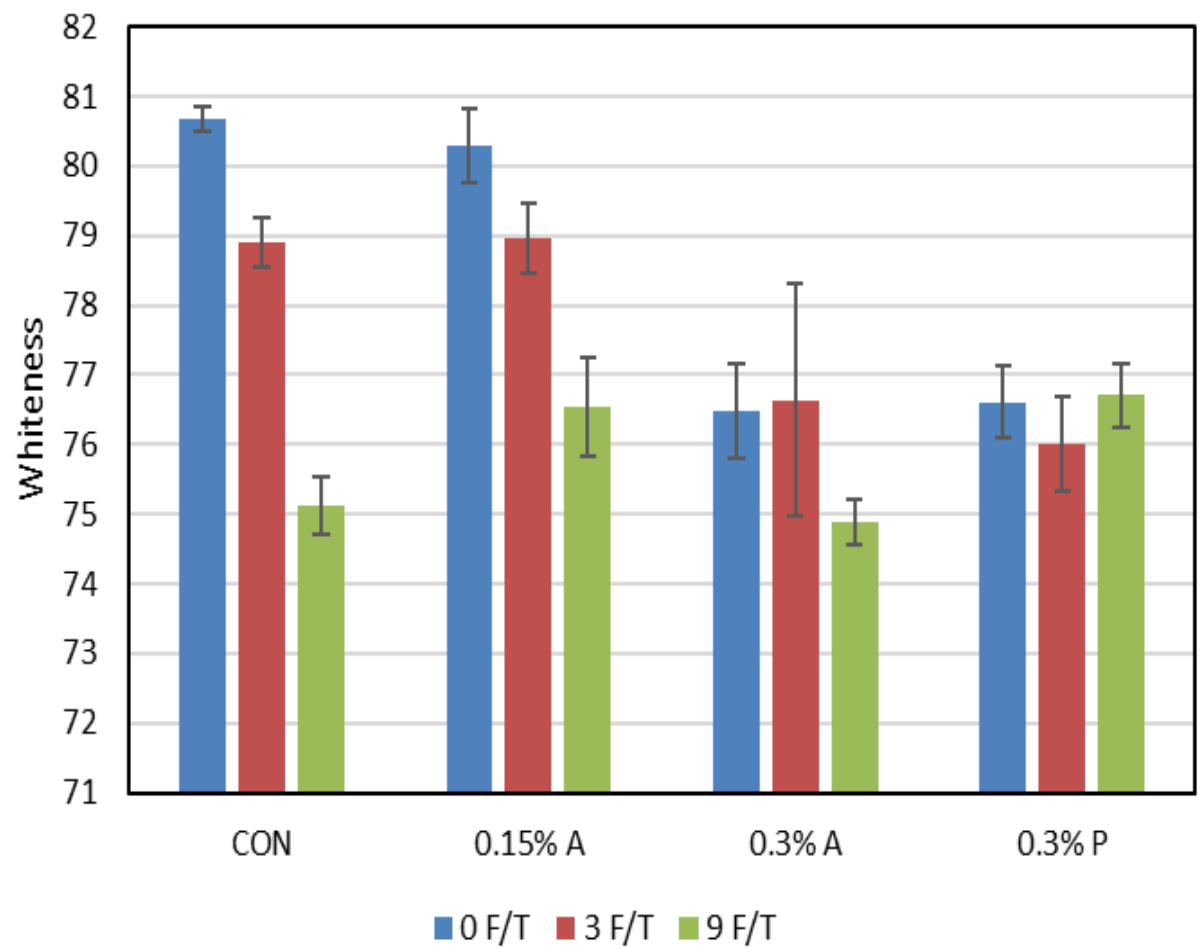
Minolta  
CR300



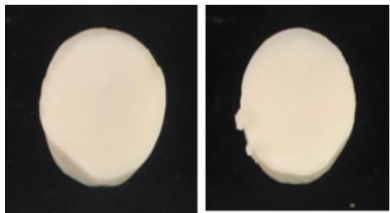
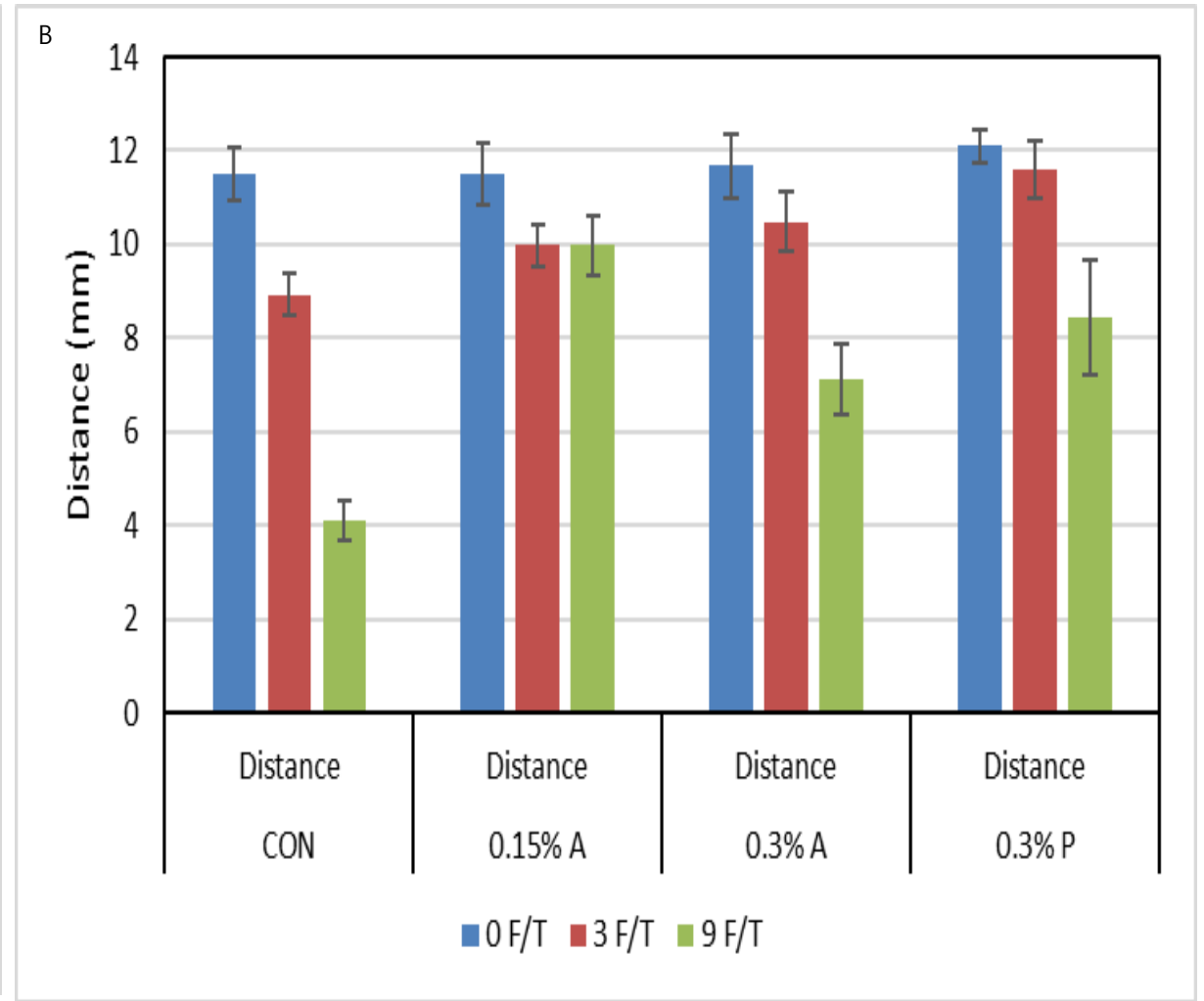
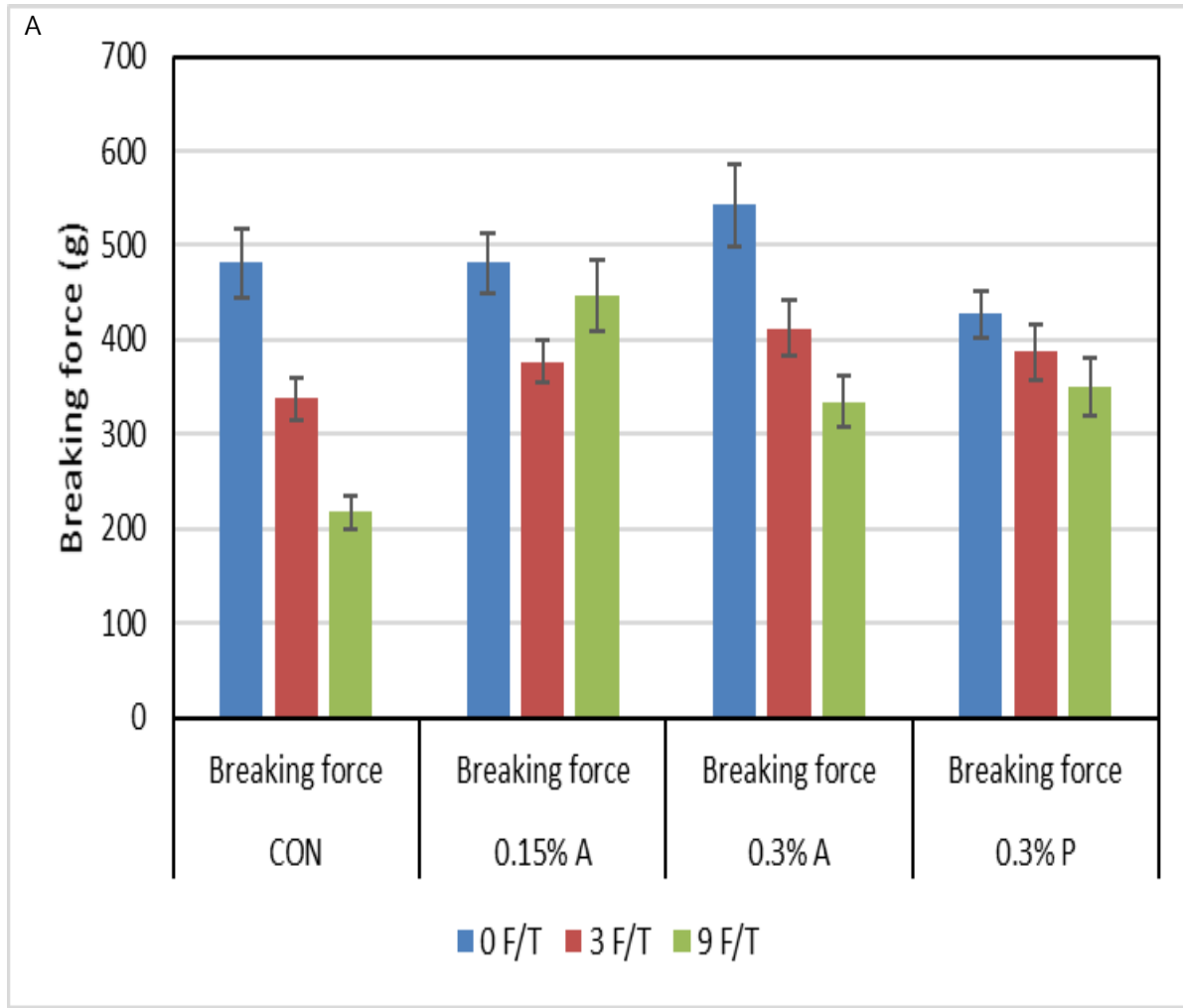
**pH of Surimi Gel**



**Water Retention Ability (WRA) of Surimi Gel**



**Whiteness ( $L^* - 3b^*$ ) of Surimi Gel**

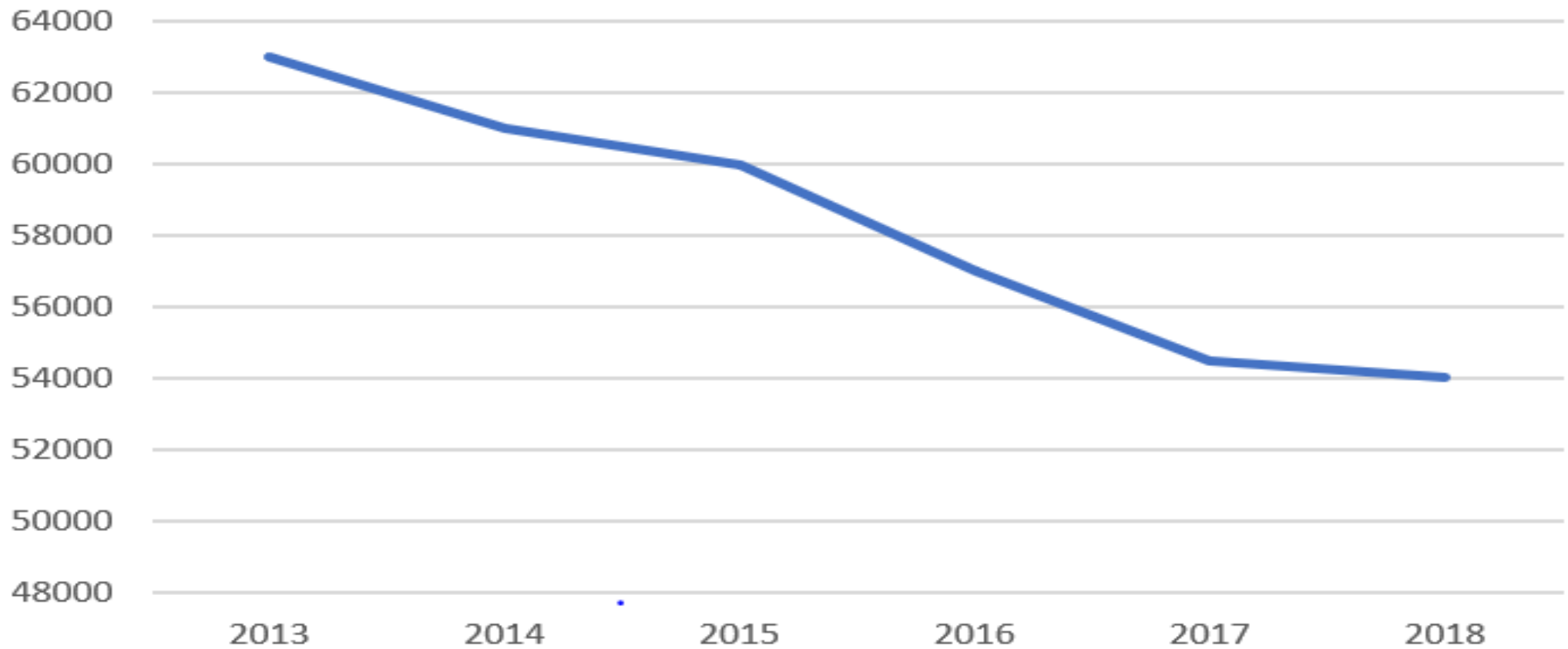


## Gel Texture of Surimi Gel

Breaking Force

Distance

## Total French Surimi Seafood Market



### Total French Surimi Seafood Market

2013	2014	2015	2016	2017	2018
63000	61000	60000	57000	54500	54000

# Summary

- Frozen surimi without sodium phosphates suffers texture reduction (if not used immediately).
- Phosphate is not a popular additive in France.
- Arginine is one of essential amino acids and consumer-friendly.
- **Arginine at 0.15% can replace 0.3% sodium polyphosphates with better texture and better color.**



# Acknowledgement

Many thanks to **Daesang Company**  
(Seoul, S Korea) for its financial  
support and samples.

**The 11th Surimi School Europe**  
**Madrid, Spain, 24-26 Sept 2019**

**The 1st Jae Park Surimi School Korea: 2019**

**The 26th OSU Surimi School/Forum USA: Spring 2020**

**The 13th Surimi School Asia (Bangkok): October 2020**

**The 4th Surimi Forum Japan (Tokyo): March 2021**