Expert's Opinion

Potato Extract (X-Tend) as a Functional Ingredient for Surimi and Surimi Seafood:

Inhibiting Protease and Enhancing Gelling Property

All surimi *except high grade Alaska pollock* **contain a significant level of proteolytic enzymes!**

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I. INTRODUCTION

Pacific whiting is harvested in the Pacific Northwest of United States and Canada. It is harvested from May through November. Pacific whiting contains a significant amount of protease that makes muscle texture soft if it is cooked slowly. Therefore the removal of these protease enzymes is critical. Even though a majority of protease is removed during washing, there is still active protease retained in the surimi. Except extremely high grade Alaska pollock surimi (SA and FA), all surimi manufactured globally contain a certain level of proteases. When cooked slowly, like in the water bath, the surimi suffers with gel softness. There are two choices to overcome the problem: 1) use of enzyme inhibitor or 2) cook rapidly.

In this report, the use of enzyme inhibitor is addressed based on effectiveness and competitiveness.

2. Enzymes: activity and inhibition

Cathepsin enzymes are known to be activated and degrade myofibrillar proteins if they are heated slowly. During surimi processing (washing/dewatering), all cathepsin H enzymes are washed away. Cathepsin B is washed away by 70% and cathepsin L is not washed away at all (Figure 1).

Therefore the best strategy is to control the cathepsin L enzyme.

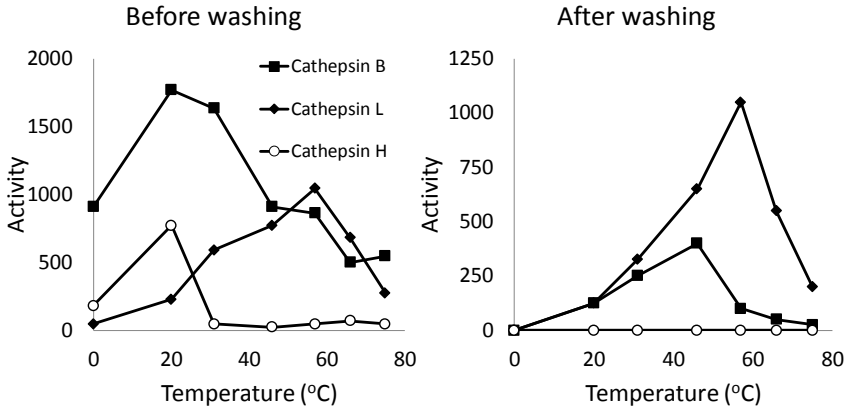


Figure 1 Activities of cathepsins (B, H, L) in Pacific mince before and after washing of the meat.
Source: Figure 5.1, Chapter 5, *Surimi and Surimi Seafood*, 3rd edition (Park, 2014).

With the development of Pacific whiting surimi industry in 1991-1992, the use of food grade enzyme inhibitor was critical. The importance of enzyme inhibitors has become more important as the surimi industry attempts to increase the production yield with various efforts (cutting more

meat, use of less water, including recovered meat, etc). This has been applied to all surimi except high grade pollock surimi.

Beef plasma protein was the most effective and popular enzyme inhibitor within the surimi industry with controlling more than 90% cathepsin enzyme (2-3% addition level of beef plasma protein). With the outbreak of BSE (Bovine Spongiform Encephalopathy), use of beef plasma in surimi became an issue to the public and dried egg white was used as a replacement. The effectiveness has been good, but the usage of DEW has often been affected by the market price. The price of DEW for the last 30 years has ranged between $3.00 and $6.00/lb until the recent price crisis. Its price was about $5.50/lb in April 2013 and reached $8.00/lb in fall 2013. It was $12.50/lb in April 2014 and $14.00/lb in June 2014. DEW is definitely in crisis.

Looking for egg white replacement containing DEW's dual functions (enzyme inhibition and gel enhancement), potato powder has become an effective candidate. The effectiveness of potato powder as an enzyme inhibitor in surimi was explored by Aksnes (1989) and Porter (1990) just before the development of the Pacific whiting surimi industry. However, potato powder was not successfully utilized due to the most popular inhibitor, beef plasma protein.

As demonstrated in Figure 2 below, the effectiveness of enzyme inhibition by dried egg white and potato powder is essentially identical. Therefore, potato powder can effectively replace dried egg white at similar usage levels.

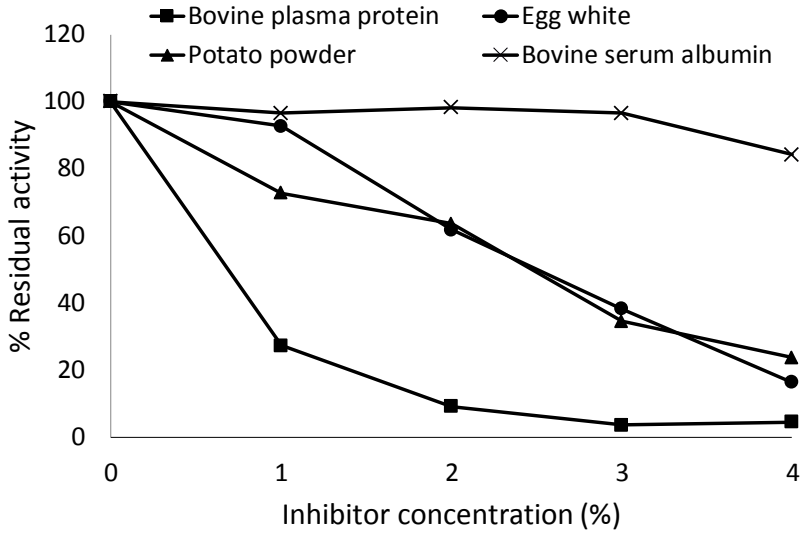
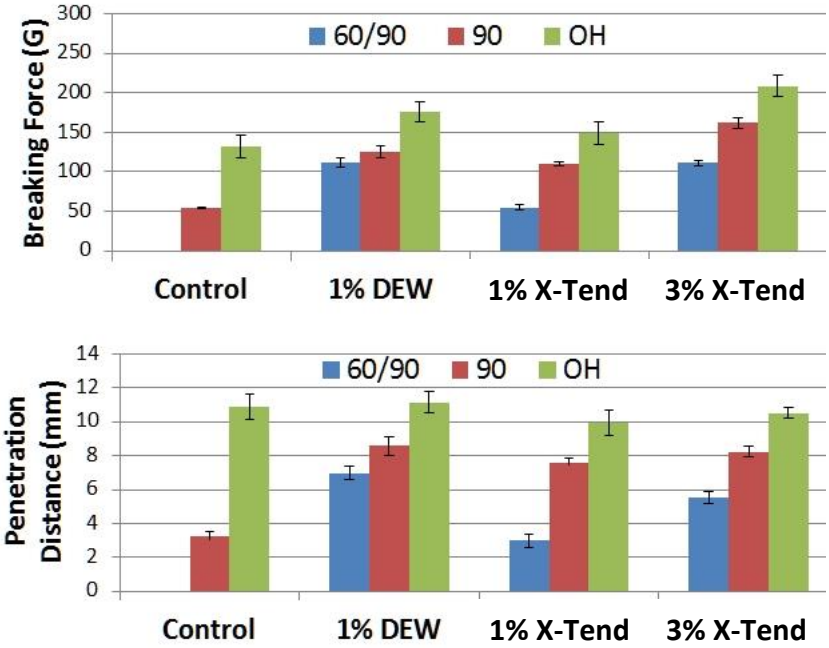


Figure 2 Trypsin activities by various protease inhibitors. *Source*: Figure 5.4, Chapter 5, *Surimi and Surimi Seafood*, 3rd edition (Park, 2014).

3. X-Tend, Potato extract powder from Basic Foods America

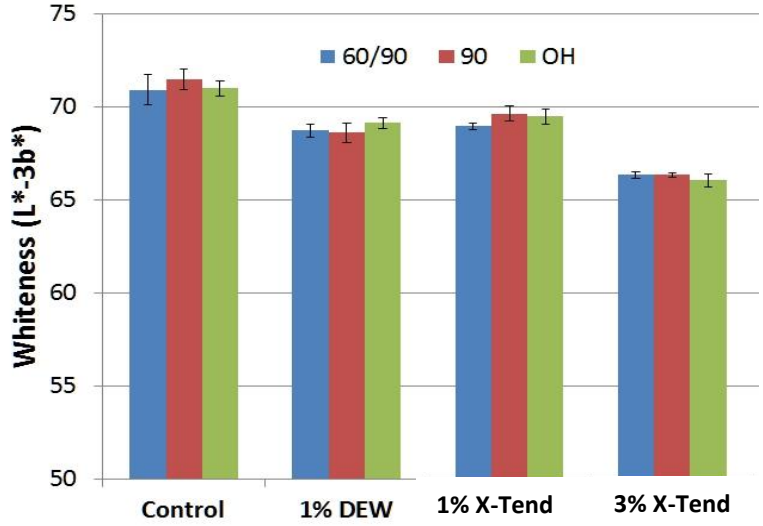
My laboratory tested X-Tend (potato extract powder) to explore its protease inhibition and gel enhancing ability compared to the effectiveness of dried egg white. 1% X-Tend performed comparatively with 1% egg white, while 3% X-Tend performed better than 1% egg white.



All gels were prepared at moisture content 78%. The control, containing no inhibitor, expressed significantly lower values when gels were cooked at 60/90C or 90C in a water bath. Since 60C is the optimum temperature for protease enzyme, no gels were formed when no inhibitor was used. However, at 1-3% X-Tend, protease activity was significantly inhibited.

Figure 3 Textural properties of Pacific whiting surimi as affected by cooking and enzyme inhibitors (egg white and potato powder).

Addition of heat-treated dried ingredients always affects the color of surimi gels somewhat negatively.



Cooking methods did not affect the whiteness significantly. However, the addition of DEW or X-Tend reduced the whiteness value slightly. At 1% level DEW and X-Tend showed similar whiteness, but X-Tend seems to be slightly better.

Figure 4 Whiteness of Pacific whiting surimi as affected by cooking and enzyme inhibitors (egg white and potato powder).

4. CONCLUSION

X-Tend functional potato powder was tested as an effective enzyme inhibitor and gel enhancer, similar to dried egg white. It can be used at 1-3% in any surimi and surimi seafood formulation to replace 1-2% dried egg white.

It is certain that the use of X-Tend over dried egg white would give a significant cost saving as shown in the table below. Based on the price of frozen surimi ($2.00/lb), the use of X-Tend (1%) over DEW (1%) would result in the saving of $0.12/lb.

	$/lb	When DEW is used		When X-Tend Potato Extract is used			
Surimi * (%)	2	99	98	99	98	97	95
DEW (%)	14	1	2	0	0	0	0
X-Tend (%)	2	0	0	1	2	3	5
Estimated cost	$/lb	2.12	2.24	2.00	2.00	2.00	2.00
Cost saving by X-Tend to replace 1% DEW				0.12	0.12	0.12	0.12
Surimi* = contains 4% sugar, 5% sorbitol, and 0.3% sodium polyphosphate							

References

Aksnes, A. 1989. Effect of proteinase inhibitors from potato on the quality of stored herring

Park, JW. 2014. *Surimi and Surimi Seafood*, 3rd edition. Boca Raton, FL: CRC Press.

Porter, RW, Koury, BJ, Kudo, G. 1990. Method for treating fish meat contaminated with sporozoa and potato product for improving heat gelation of fish muscle. US 4,935,192.

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