CFAES

Department of Food Science and Technology

# Utilization of acid whey as a fermentation aid to developing an enriched feed ingredient

A.C. Mayta-Apaza*, I. Garcia-Cano, A. Marciniak R. J. Ortega-Anaya, and R. Jimenez-Flores
*Department of Food Science and Technology, The Ohio State University, Columbus, OH, 43210

## INTRODUCTION

- The dairy industry produces vast amounts of waste streams. Likewise, the fishery industry discards about 45% in weight of a single fish.
- Their high-quality protein and natural acidity are of nutritional interest. Utilizing fermentation processes which are known to add nutritional and economic value.
- Complex proteins cannot be fully digested and absorbed; hence, fermentation could increase the bioavailability of these nutrients.
- Fermentation of the mixture of acid whey (Aw) and fish waste (Fw) will break down complex nutrients, increasing its nutritional value and could be use as an ingredient for animal diets.

## OBJECTIVE

Optimized fermentation parameters using lactic acid bacteria in a mixture of Aw and Fw with and without a carbohydrate source.

## MATERIALS AND METHODS

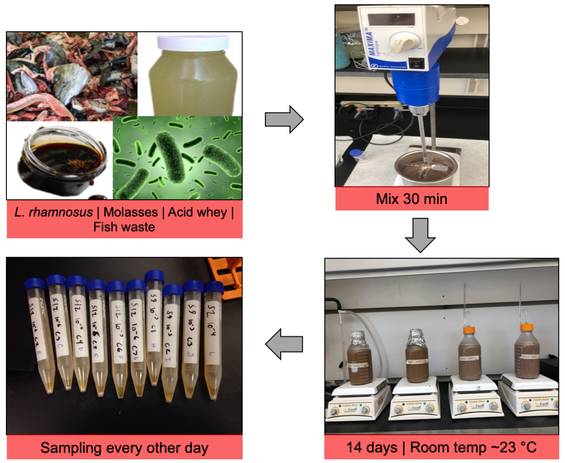


**Figure 1.** Experimental flowchart for the preparation of fermentation systems. Two treatments: Aw+Fw and Aw+Fw+Mol, run in duplicates for 14 days.

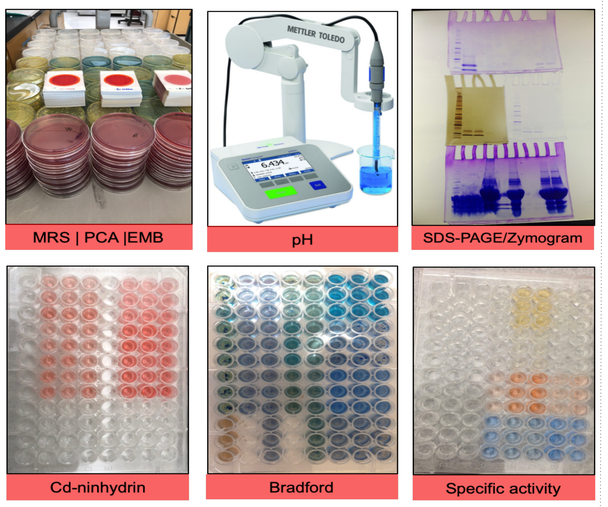


**Figure 2.** Experimental methods:
Microbiological: MRS→ LAB; PCA→ total count; EMB→ total coliforms.
Protein: Cd-ninhydrin→ peptide quantification; Bradford→ soluble protein; Specific activity→ hemoglobin; SDS-page/zymograms and pH.

## RESULTS

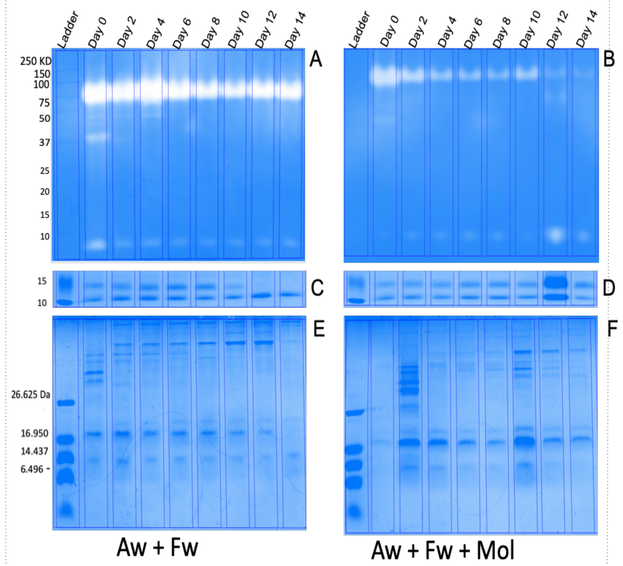


**Figure 3.** Protein profiling using A-B: Zymogram10%; C-D: SDS-PAGE 10%; E-F: SDS-PAGE 17.5% for each treatment every other day.

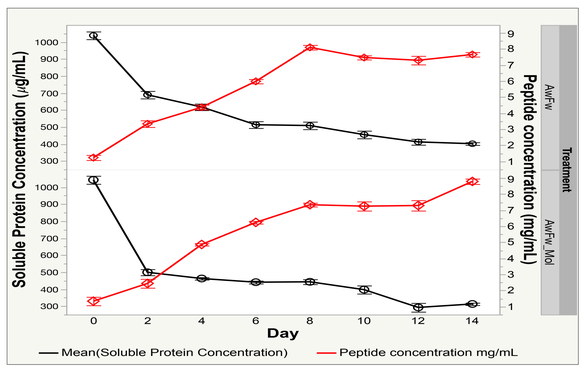


**Figure 4.** Protein degradation monitoring for 14 days.

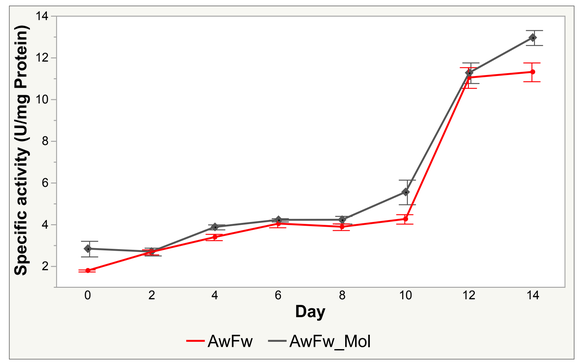


**Figure 5.** Enzymatic degradation dynamics using Specific activity from the fermentation systems.

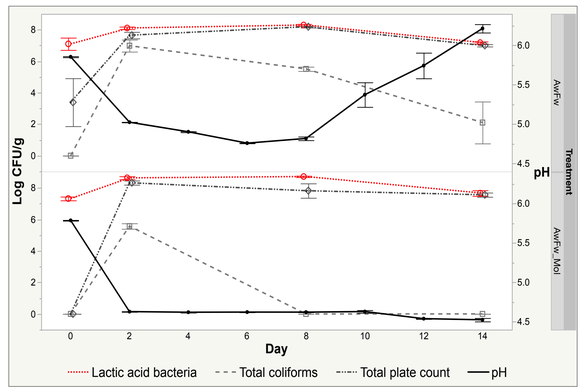


**Figure 6.** Bacterial cell count and pH dynamics per batch of fermentation over 14 days.

- pH of both systems dropped significantly (*P<0.005*) around day 2 from 5.88 to 4.09 each with distinct patterns.
- Microbial cell growth increased significantly (*P<0.005*) at day 2 except for total coliform, which also decreased significantly after day 8.
- Soluble protein decreased significantly (*P<0.005*) in contrast to peptides concentration that increased about 3.6 times at by day 14.
- As specific activity increases likewise do the concentration of peptides as observed in figures 3, 4, and 5.

## CONCLUSIONS AND DISCUSSION

- LAB strain *(L. rhamnosus)* was efficient in lowering the pH of the system and breaking down complex protein structures.
- Treatment with added carbohydrate reached lower pH values in a shorter time and higher overall proteic activity resulting in a greater concentration of peptides in the last day (~8 times more than day 0).
- Acid whey offers medium to harbor LAB strains as well as conditions for more significant interaction between medium-microorganism.
- Fermentation has shown to have an effect over the composition of protein making an enriched ingredient for animal diets.

## BIBLIOGRAPHY

- Eş, I., A. M. Khaneghah, F. J. Barba, J. A. Saraiva, A. S. Sant'Ana & S. M. B. Hashemi (2018) Recent advancements in lactic acid production-a review. *Food research international,* 107**,** 763-770.
- Love, D. C., J. P. Fry, M. C. Milli & R. A. Neff (2015) Wasted seafood in the United States: Quantifying loss from production to consumption and moving toward solutions. *Global Environmental Change,* 35**,** 116-124.
- Yang, F., W.-S. Xia, X.-W. Zhang, Y.-S. Xu & Q.-X. Jiang (2016) A comparison of endogenous and microbial proteolytic activities during fast fermentation of silver carp inoculated with Lactobacillus plantarum. *Food chemistry,* 207**,** 86-92.

## ACKNOWLEDGEMENTS

This study was supported by the JT Stubby Parker Endowment in Dairy Foods at The Ohio State University.

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES