Utilisation of Cod Processing Side Streams (Heads and Backbones) for Improved Fish Meal Production

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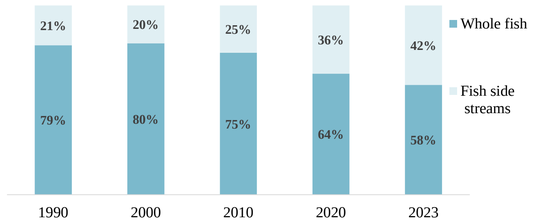
BACKGROUND

Icelandic cod has an annual output of 210,000 tones. Currently heads and frames are dried and sold to Africa, with low economic value and high market risk. Other available methods for utilisation of side streams are e.g. fish meal production. Fish heads and frames are generally not good raw material for meal production due to their high ash content attributed mainly to minerals found in the bones.




Cod


Cod head


Cod frame

PURPOSE AND SIGNIFICANCE

Purpose of the study:

Evaluating opportunities for using separation technologies to separate bones in heads and frames from soft tissue to enable fish meal production from these side streams. Further, to provide information on potential for raw material handling options for cod side streams, assessing the impact of storage conditions and time and processing order on the quality of cod side streams and the produced fishmeal.

Research objectives:

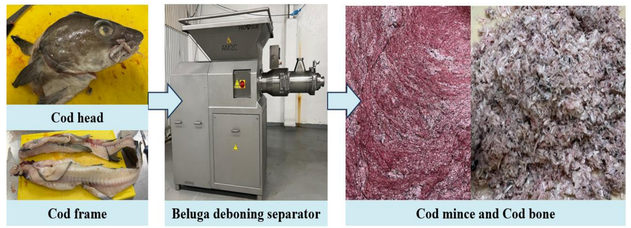
1. Evaluate effects of temperature (0°C vs. 5°C) and storage time (0-7 days) on cod side-stream spoilage (TVB-N).
2. Analyse how mechanical separation (mincing) impacts decay and quality.
3. Determine storage strategies for cod head/frame intented for fishmeal production.
4. Analysing the composition of cod bones and exploring potential applications.

MATERIALS AND METHODS

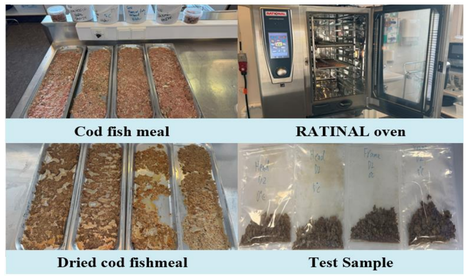
Experimental methods

Cod heads and frames were collected and processed using a Beluga deboning separator. The mass balance of the separation was collected. Separated soft tissue was packed into Styrofoam boxes with ice and shipped alongside whole heads and frames on ice to Matís for a comparative evaluation of stability of separated samples or mince and whole heads and frames.

To assess the quality changes of the samples TVB-N in fish heads, frames and corresponding mince at storage temperatures (0°C and 5°C) and times (0, 3 and 7 days), were evaluated.



To determine the effects of raw material quality on processed fish meal mince was dried and analysed for compositional and quality parameters.



Finally, the bone mass from the separation process was evaluated. First the bones were heated and rinsed to determine how much residual soft tissue remained with that stream. Then the remaining masses composition was analysed to determine potential for valorsation.

RESULTS

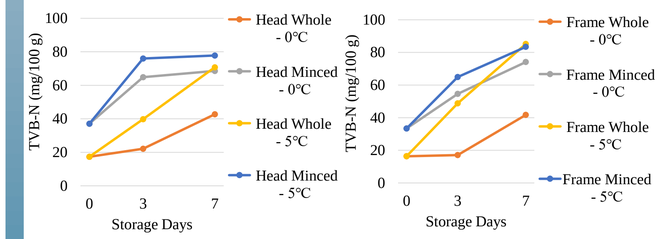
1. Mass balances during separation

Evaluation of mass balances was performed during the separation. The heads and frames provided 85% and 81% of their mass as soft tissue respectively. Results of chemical analysis of the stream of bones and soft tissue showed that the separation provided effective removal of ash from the original raw material indicating it would be a beneficial step prior to fish meal processing to provide a higher value fish meal from this raw material.

2. Effect of storage conditions on the spoilage process of cod heads and frames

TVB-N of minced and separated heads/frames was significantly higher than that of intact heads/frames, with the TVB-N of frames at 5°C being ↑104% compared to 0°C.

All minced samples exceeded the regulatory limit for human consumption of fish for TVB-N at the start of storage which is 35 mg TVB-N/100 g sample. Another regulatory limit for TVB-N of more relevance is the limit for production of fish oil for human consumption and that can be the quality limit set by fish meal processing companies when evaluating raw materials. Minced samples stored at 5°C exceeded that limit at day 3 of storage while minced frames were slightly below at that time. All minced samples exceeded that level at day 7 while this was not the case for all whole samples.

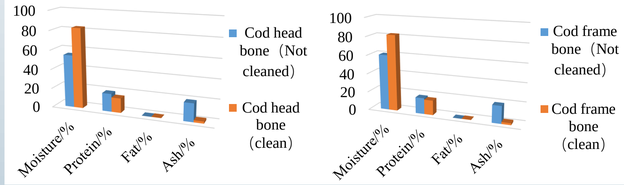


3. Impact of raw material storage on produced fishmeal quality

TVB-N was used to evaluate quality of fishmeal. In general the TVB-N was highest for fishmeal processed from minced frames stored at 5°C indicating raw material quality has an impact. Changes in other compositional parameters were small and mostly related to the variability of the samples and impacted by sampling and drying protocols.

4. Compositional analysis of bone stream

The composition of the bone stream changed due to cleaning. Water content increased with rinsing. The bone stream from heads and frames lost a total of 30% and 40% respectively of total weight through the rinsing process indicating a substantial amount of other material was still present in the stream following separation that was then removed during the cleaning step. Further research is needed to determine the best method to use this bone stream, it could have the potential to be used in feeds, supplements, and biomaterials.



CONCLUSIONS

1. Separation and effect of quality during storage

Separation was successful in lowering the amount of ash that would enter fishmeal processing lines if heads and frames would be used as a raw material ensuring a higher price for the final product. Further, the separation provides opportunity for valorisation from the bone stream. During storage the daily increase in TVB-N at 5 °C is overall higher than 0 °C for both cod heads and frames, therefore, storage at 0°C is recommended. Whole heads and frames were more stable and could be kept in 0°C storage for more than 7 days or at least 3 days at 5°C but minced material should be kept for less than 3 days at 0°C depending on the quality limit being used.

2. Raw material quality effect on fishmeal

Raw material quality had some impact on quality of final fish meal, e.g. with increased TVB-N generally seen in fishmeal made from samples that had been stored at 5°C. be stored at 0 °C.

3. Residual bone utilisation potential

After cleaning, the weight of the skull/frame bone decreased, moisture increased, ash decreased, iron appeared, and more protein was retained. The residual bone contains a lot of nutrients and can be utilised at a high value.

ACKNOWLEDGEMENTS