SeaHealthUCD

Issue 18: November, 2015: This e-bulletin is aimed at personnel in fisheries & aquaculture, at fish packers, processors, distributors, retailers, health professionals and consumers.

Wealth from fish processing effluents

Outcomes from this Nordic study were presented at the NutraMara Conference (Dublin, June 2015) by Caroline Baron (DTU, National Food Institute, Denmark) and Ingrid Undeland (Chalmers University of Technology, Sweden). The title of the project (2012-2015) is 'Pelagic industry processing effluents, innovation and sustainable solutions' (PIPE) and it embraces three Nordic universities, two producer companies, three technology companies and has a budget of 1 million Euro.

Aims of PIPE project

The project addressed four main areas: (i) solve the problem of high organic load effluents in the marinated herring industries; (ii) characterize the composition of the different types of effluents produced during the process; (iii) separate and recover high value proteins and fats/oils from the effluents; (iv) investigate the potential market for the recovered/concentrated materials.

Water usage in marinated herring production

Water is used at many stages in marinated herring production and this water picks up valuable solids (protein and other components) along the way. Firstly there is the water from boat to barrel (BB) and then water from barrel to jar (BJ). BB includes refrigerated seawater in which the fish are stored on board the trawler; salt water used during size sorting and storage; fresh water used during heading, gutting, filleting; fresh salt brine used for short term storage. BJ water includes water containing salt, sugar and spices used during ripening in barrels; fresh water for desalting; fresh sugar brine used during de-acidification; cleaning water used during packaging. Total water usage is estimated at more than 7 cubic metres per ton of herrings processed.

Separation techniques

These embrace (i) pre-treatment using electrochemistry; (ii) pre-treatment using dead-end 50µm polypropylene filters; and (iii) ultra-filtration using ceramic membranes. Research in Denmark

estimated that the concentration of total proteins and fatty acids in herring storage water incubated up to four days was about 17 and 4g/litre respectively. Extrapolating from this it is estimated that 10kg of protein and 4kg of fatty acids can be recovered from water used in processing 1 tonne of herring in the BB phase and a further 110kg (protein) and 40kg (fatty acids) in the BJ phase. This amounts to a potential total protein and fatty acid recovery of 120kg and 44kg respectively per tonne of herring processed. In the current study separation by electrochemistry and ultrafiltration was found suitable for recovery from BB waters while polypropylene filters and ultrafiltration were best for recovery from BJ waters. Average retentions from the BJ waters were 70% (protein), 98% (fatty acids), 98% (n-3 polyunsaturated fatty acids) and 38% [total phenolic compounds (antioxidant potential in humans)].

Conclusions

There were four main conclusions: (i) process waters from marinated herring industry contain substantial amounts of proteins, fats/oils and some potential antioxidants (phenolic compounds from spices used); (ii) technologies tested are potential techniques for the recovery of proteins (75–85 %) and fats/oils (95–99 %) but need optimisation; (iii) the application of such technologies significantly decreases the need for treatment i.e. greatly reduced biological and chemical oxygen demand associated with herring process waters; (iv) sustainability of marinated herring industry can be improved and should be an area of interest (>300 tons proteins and >100 tons fatty acids are wasted yearly).

While the PIPE project is on effluents from marinated herring industries, the concept can be applied to effluents from other fish processing industries and should be of interest to Irish fish processors. This is the third step in the progression from (i) using only edible fish flesh, to (ii) total fish utilisation, to (iii) recovering value from processing waters.

NutraMara

NutraMara is an all island initiative focusing on mining functional food ingredients (which may benefit human health) from marine bio-resources. The project has six partners: Teagasc (Ashtown and Moorepark Food Research Centres), UCD, UCC, NUI Galway, UL and Ulster University. The project Director is Declan Troy and Manager Brijesh Tiwari both of Teagasc Ashtown Food Research Centre. More information at http://www.nutramara.ie/

Compiled by Professor Ronan Gormley of the UCD Institute of Food and Health, School of Agriculture & Food Science, Belfield, Dublin 4.