

# HIGH ADDED VALUE COMPOUNDS FROM COD FISH PROCESSING

V. Ferraro<sup>1,2</sup>, I. B. Cruz<sup>1,2</sup>, R. Ferreira Jorge<sup>2</sup>, F. X. Malcata<sup>1</sup>, M. E. Pintado<sup>1</sup>, and P. M. L. Castro<sup>1</sup>

<sup>1</sup> *Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Rua Dr. Antonio Bernardino Almeida s/n, 4200 – 072 Porto, Portugal*



<sup>2</sup> *WeDoTech – Companhia de Ideias e Tecnologias, Lda., CIDEB - Escola Superior de Biotecnologia, UCP, Rua Dr. Antonio Bernardino Almeida s/n, 4200 – 072 Porto, Portugal*



## 1. Introduction

Salt-cured cod continues to be widely produced due to low technology costs, simplicity of processing and highly appreciated sensory characteristics. Since ready-to-use products demand is increasing, the desalting/rehydration step is being included in the industrial process. This operation first reduces, by leaching, the salt concentration in the cured cod from 15 – 20% (w/w) to 2 – 3% (w/w), which is an acceptable level for consumption. Additionally, it improves texture of the fish muscle by reduction of hardness, since connective tissue is compacted during the salting process. However, some relevant operational problems are also risen, since 0.2 – 0.5 m<sup>3</sup> of exudates from the fish are generated for each ton of cod during salting and drying step, as well as wastewater equivalent to 9 times the weight of the cod is produced. Both residues are treated as dangerous wastes due to high content of chloride and organic load originated from the leaching of the salt, which also implies the solubilization of proteins with high molecular weight. It is estimated that ca. 7 % by weight of fish muscle protein, myosin and actine, passes into the water phase during the rehydration process up to 2.4 g/100g and of 70 mg/100g of the free amino acid taurine, representing an effective loss of important nutritive compounds. The potential of these by-products as well as fish flesh residues as new sources of high added value compounds, particularly **glycine**, **creatine**, **L-alanine** and **taurine** — important amino acid with unique characteristics and often used as a supplement in various food and pharmaceutical applications, is under evaluation by different analytical methods like HPLC – UV and LC – MS/MS.

## 2. High added value compounds in cod fish processing residues

Around 5 millions tons of the European marine capture (14 millions tons yearly) are discharged as waste every year. Only 41% of cod fish and other pelagic fish ends up as a final product. Curious as provocative, the highest concentrations of the bioactive compounds beneficial for human health promotion, are found in those parts normally discharged (Fig.1), currently used for the fishmeal and fish oil production (market price: 46 Euro/kg).

**Head** **Protein:** 13.9% – 16.4%, **Fat:** 0.9% - 10.9%

**Viscera** **Protein:** 13% - 15.3%, **Fat:** 2% - 19.1%

**Backbone** **Mineral Hydroxyapatite:** 60% - 70%

**Skin** **Biopolymer Collagen:** 80%

**Scales** **Biopolymer Collagen:** ca. 50%, **Mineral Hydroxyapatite:** ca. 50%

**Liver** **Lipid:** 50% - 80%. about 23% is the  $\omega$ -3 PUFA Eicosapentanoic acid (EPA 22:5n3)

**Flesh** **Free amino acids:** ca. 160 mg/100g of taurine and 1700 mg/100g of creatine on wet tissue

**Blood** **Anti-freeze proteins:** 5 mg/ml – 35 mg/ml depending upon sea water temperature



## 3. High added value compounds in cod fish processing wastewater

Tab. 1. Characterisation of cod fish processing wastewater

| Parameter  | Concentration in the liquid waste |                   |                   |
|------------|-----------------------------------|-------------------|-------------------|
|            | Exudates                          | Water on exudates | Rehydration Water |
| Dry matter | 83,7 g/100g                       | 35,6 g/100g       | 0,1 g/100g        |
| Ash        | 81,17 g/100g                      | 22,41 g/100g      | < 0,01 g/100g     |
| Fat        | < 0,1 g/100g                      | < 0,1 g/100g      | < 0,1 g/100g      |
| Protein    | 1,9 g/100g                        | 2,4 g/100g        | < 0,1 g/100g      |
| SFA*       | < 0,1 g/100g                      | < 0,1 g/100g      | < 0,1 g/100g      |
| PUFA       | < 0,1 g/100g                      | < 0,1 g/100g      | < 0,1 g/100g      |
| MUFA**     | < 0,1 g/100g                      | < 0,1 g/100g      | < 0,1 g/100g      |
| Salt       | 82,9 g/100g                       | 21,6 g/100g       | 0,05 g/100g       |
| TAURINE    | 0,64 g/Kg                         | 0,70 g/Kg         | 0,04 g/Kg         |

The wastewater supernatant on exudates has an interesting content (70 mg/100g) of the free and sulphated amino acid **Taurine** (NH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-SO<sub>3</sub>H) highly soluble in water (Tab. 1). Fresh cod possesses an amount of **Taurine** equals to 160 mg/100g on wet tissue. During salting and drying, cod fish fillets lose 43% of **Taurine**, an amount equals to the structural water losses (from 83% of water in fresh cod to 47% of water in dried cod).

(\*) Saturated fatty acids (\*\*) Monounsaturated fatty acids

## 4. Main Conclusion

**The work so far carried out suggests that cod fish processing wastewater as well as cod fish residues can be used as a source of natural bioactive compounds**

## 5. Future work

The InSolEx project aims at developing state-of-the-art technologies for the extraction of added value compounds from waste products generated at agro-food industries. At present, target waste sources have been selected from a major portuguese fish industry (Pascoal, Lda.) and identification of main products present has been carried out. Future steps will involve further characterisation of products present in cod fish processing residues and investigation into the optimisation of extraction technologies both at laboratorial and pilot-scales.