Hydrothermal liquefaction of fish processing by-products towards biofuel intermediates

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Introduction

- **Millions of tonnes of fish processing by-products are generated annually → MAJOR environmental - disposal challenges**
- **HTL provides an efficient pathway for converting wet fish processing residues into energy-dense biocrude**
- **Valorization of seafood industry waste through HTL supports circular economy strategies while producing renewable fuels**

Materials - Methodology

Raw Material	Lipids (wt.%)	Proteins (wt.%)	Ash (wt.%)
Mullet Roe	**23.7**	57.0	7.0
Striped Mullet Roe	8.2	78.9	7.7
Striped Mullet Roe (ethanol extraction)	4.8	81.4	7.4
Gilthead seabream (Trimming)	21.6	46.6	7.2
Gilthead seabream (Intestines, stomach)	19.7	33.9	14.2
European Seabass	20.4	59.8	2.6
Nototodarus Sloanni	8.3	36.6	2.6

Main Objectives

- **HTL Screening Tests**

Optimization of HTL conditions (Mullet Roe)

- **Comparative study**

Effect of feed composition on HTL products

HTL Parameters

- **Solvent:** Deionized water
- **Biomass/solvent ratio:** 1/10
- **Temperature: 300^{o} – 360^{o}**C
- **Residence time:** 30 min
- **Inert gas:** Nitrogen 30 bar

Batch autoclave reactor

Products separation

1. Gas sampling
2. Mixture filtration
3. Aqueous phase removal
4. Acetone extraction
5. Solvent evaporation
6. Solid residue drying

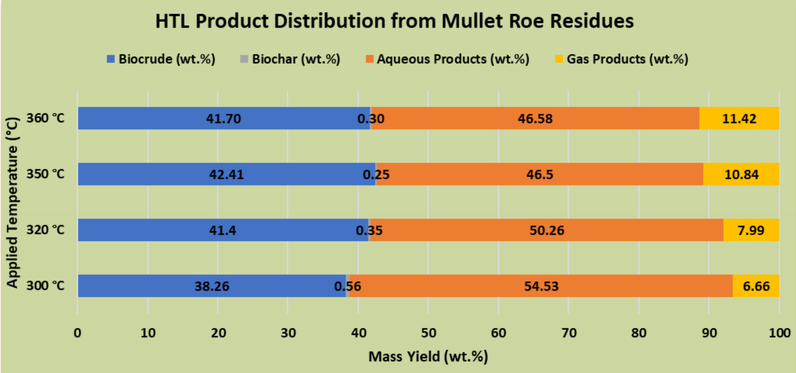
Gas Product

Solid residue

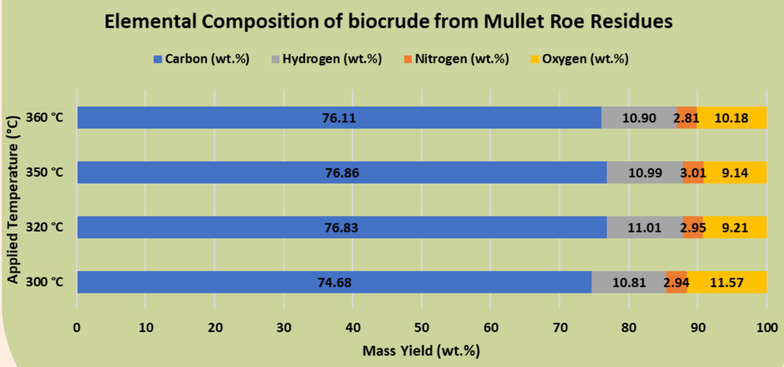
Biocrude

Aqueous Phase

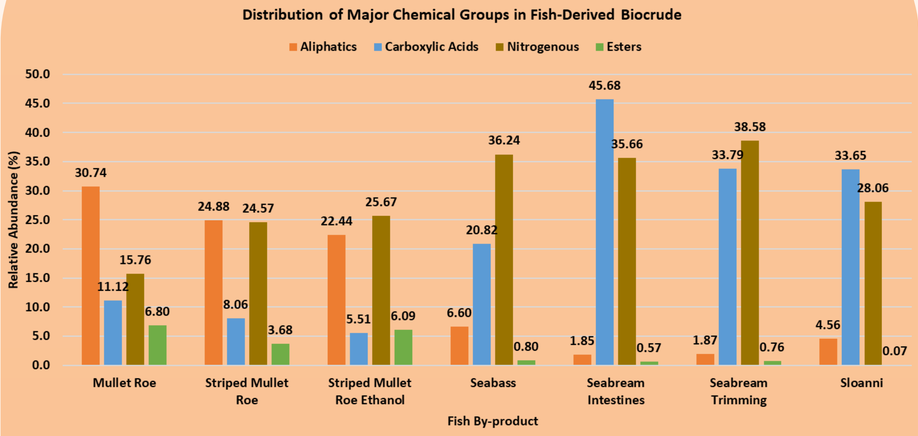
Screening Results



- Successful biocrude production
- Optimal Temperature 350°C **(42.4 wt.%)**
- Low residue yield **(high conversion rates)**
- Significant Carbon content (**>74 wt.%**)
- Deoxygenation occurs in higher temperatures



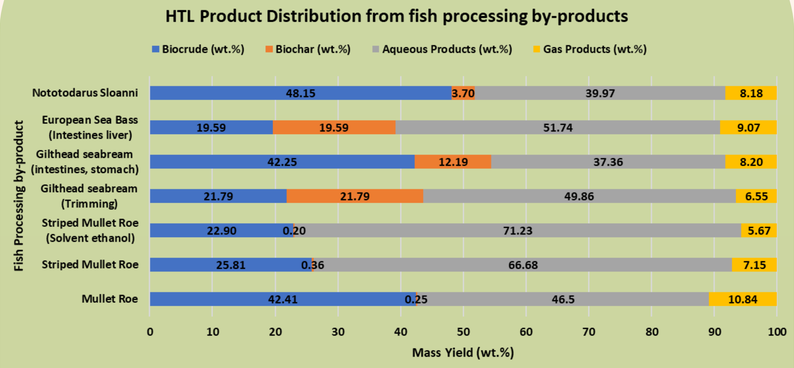
Biocrude Chemical Composition



- **Significant quantities of biofuel precursor molecules (C14 – C20)**
- Major Chemical Groups from lipids - proteins:

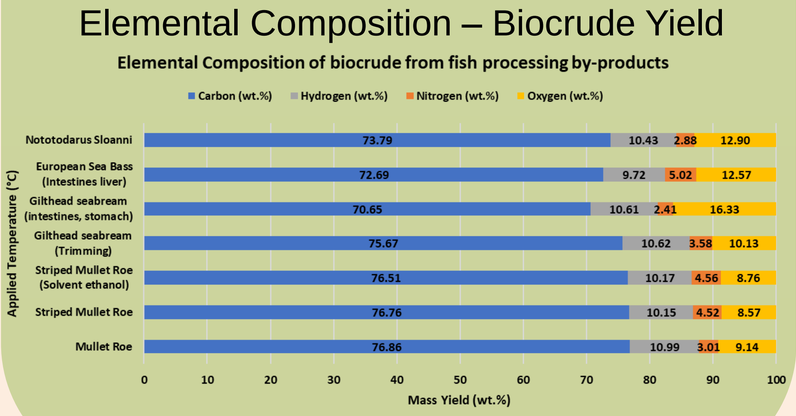
  Carboxylic Acids – Nitrogenous Compounds
- **Mullet Roe:** Enhanced hydrocarbon formation due to improved deoxygenation pathways

Comparative Results



- **Biomass composition impacts yields**
- Higher biocrude yield in **Mullet Roe – Gilt. Seabream Intestines – Not. Sloanni**
- **High** Ash content → **High** solid residue
- Significant Carbon content (**>70 wt.%**)
- **No correlation** between:

  Elemental Composition – Biocrude Yield



Conclusions

- **Promising fish waste valorization**
- **Feedstock-dependent product distribution**
- **Enhanced deoxygenation in Mullet Roe**
- **Energy-dense biocrude obtained**

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