Poster D11 (127)

Cascade approach to valorize okara by using subcritical water to obtain bioactive compounds

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BIOMASS BACKGROUND

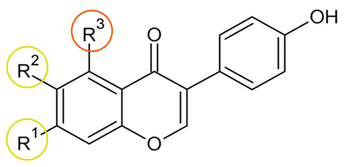
OKARA

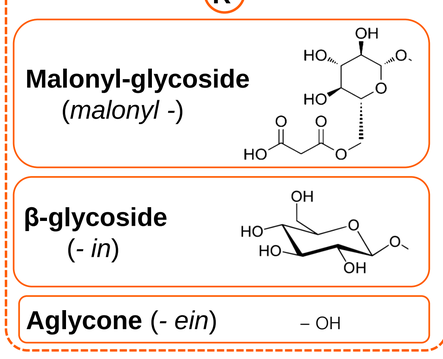
> 14 million tonnes

> 4 million tonnes

Protein	31.9 %
Lipid	10.4 %
Fiber	35.0 %
↑↑ ISOFLAVONES	

ISOFLAVONE STRUCTURE





	R1	R2
Genistin	–OH	–H
Daidzin	–H	–H
Glycitin	–H	–OCH3

Great potential health benefits

OBJECTIVES

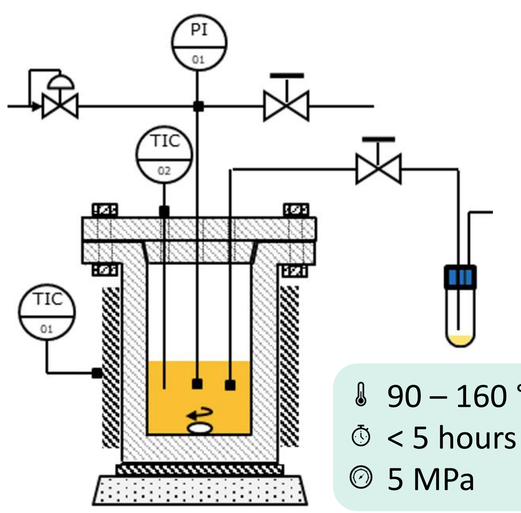
Optimization approach to cascade valorization of okara waste by subcritical water extraction in different stages:

1. Studying isoflavone extraction at mild extraction conditions (from 90 °C to 160 °C) in the previous dried okara by-product and in the crude okara (no pre-treatment)

2. The solid residue after mild subcritical water extraction conditions was subjected to more severe extraction conditions to hydrolyse the valuable protein fraction of the okara

SUBCRITICAL WATER (subW) EXTRACTIONS

1st step: BATCH

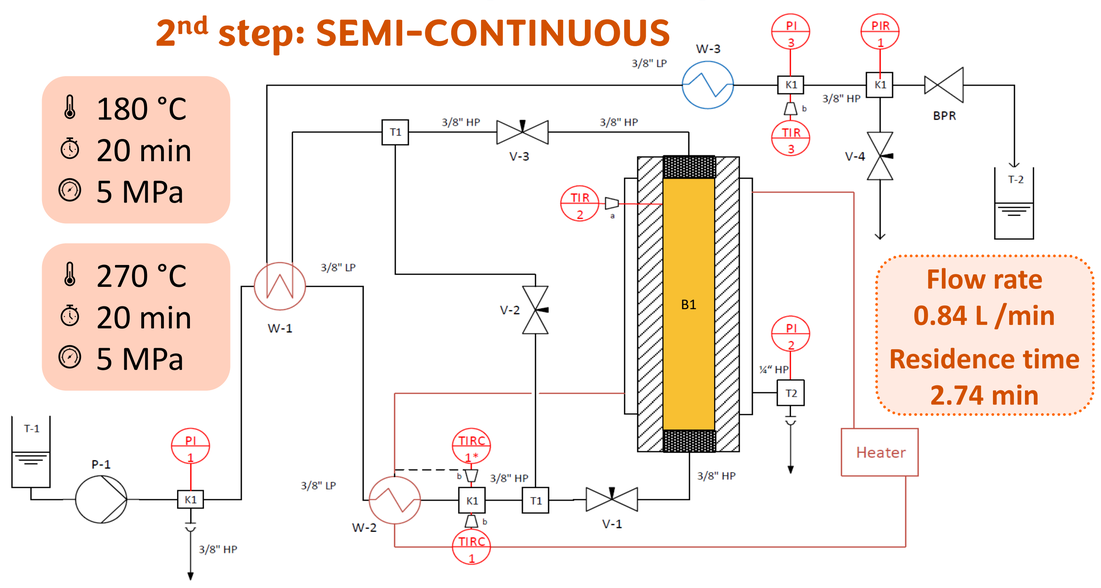


90 – 160 °C
< 5 hours
5 MPa

2nd step: SEMI-CONTINUOUS

180 °C
20 min
5 MPa

270 °C
20 min
5 MPa

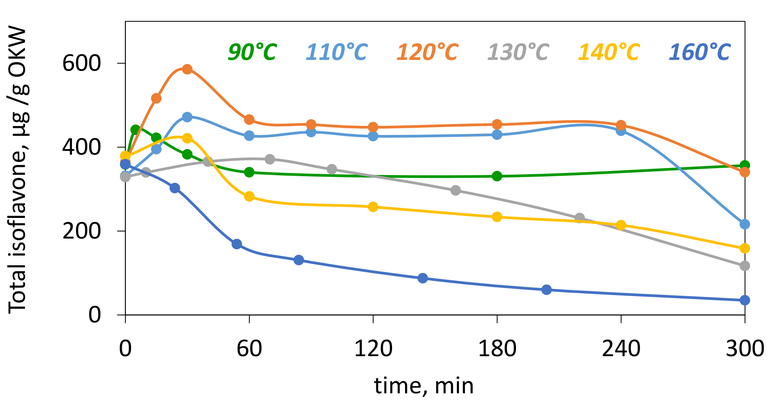


Flow rate 0.84 L /min
Residence time 2.74 min

RESULTS

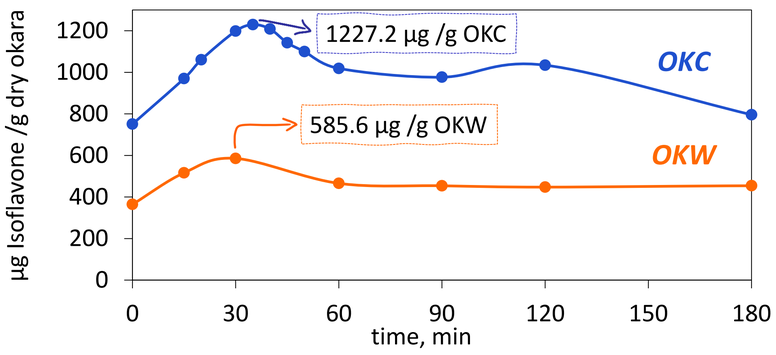
1st step: Batch results → Isoflavone extraction

OKW subW extractions



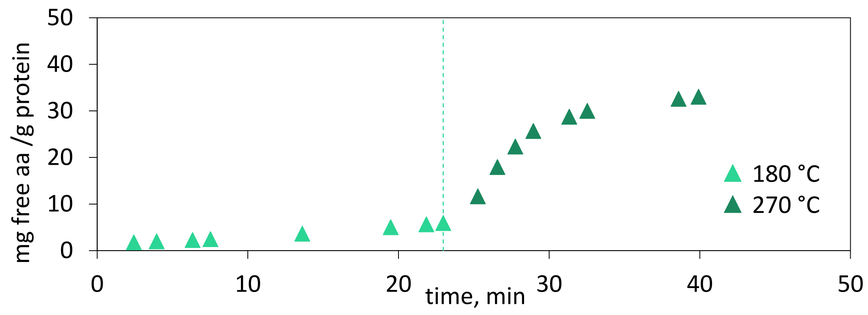
- Highest extraction at mild conditions: **110 – 120 °C**
- **120 °C for 30 min → 585.6 µg /g OKW**
- ***Degradation:*** **≥ 130 °C or > 30 min**

Isoflavone extraction (120°C): OKW / OKC



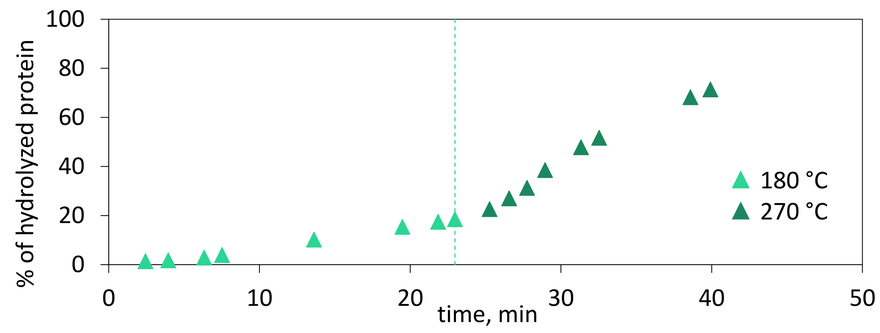
- ↑ **210 %** isoflavone when okara was not pre-treated

2nd step: Continuous results → Protein extraction



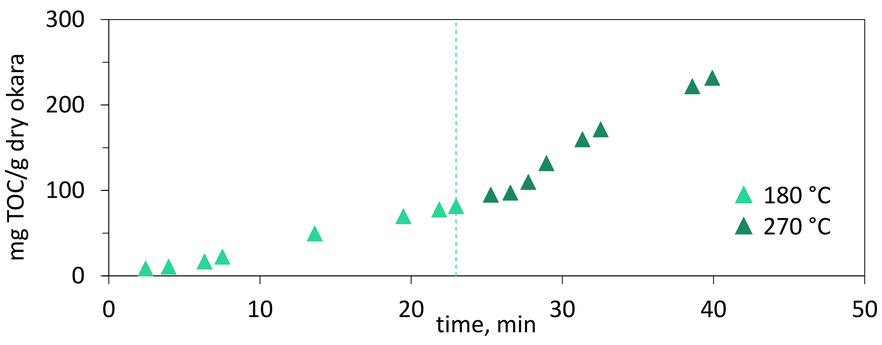
Free AA extraction

- Very low free amino acid extraction on temperatures around 180 °C
- Maximum value of 33 mg free amino acid /g protein extracted after 20 min at 270 °C



Yield of protein hydrolysis

- Yields around 18.5 % after 20 min at 180 °C
- Yields higher than 70 % after 20 min at 270 °C



Solubilization of organic Carbone

- 16.7 % of total organic carbon was solubilized after 20 min at 180 °C
- Less than 50 % of total organic carbon was solubilized after 20 min at 270 °C

CONCLUSIONS

- Best subW batch operating conditions for maximizing isoflavone extraction are 120 °C for 30 min at 5 MPa
- Genistin and Daidzin (glycosylated forms) are by far the most prevalent isoflavone in all the okara extract
- It is possible to extract larger quantities of isoflavones (1227.2 µg /g okara) from the non-pretreated okara (OKC), 210 % higher than when washed and dried okara (OKW) is used
- Remaining solid from isoflavone extraction (OKC) can be used for protein extraction yielding more than 70 %
- Less that 50% of the organic carbon from the remaining solid get solubilized using 270 °C in semi-continuous subW configuration

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