Improvement of rapeseed meal quality by using a new ethanol-hexane extraction sequence

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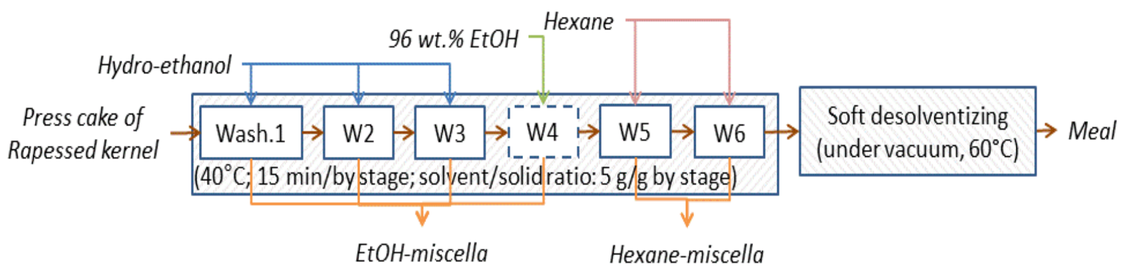
BACKGROUND

Rapeseed extraction by aqueous ethanol results in higher protein content and lower level of antinutritional factors by removing polar components (such as glucosinolates, carbohydrates and polyphenols). The major problem is the high energy required to evaporate this solvent because of its high water content. As a consequence, the desolventizing cost would be increased and the high temperature could extensively denature proteins in the rapeseed proteins concentrate (RPC).

OBJECTIVE

This work studied the influence of additional extraction steps using hexane after hydroalcoholic extraction. The idea was to try to remove the residual wet ethanol from the marc by rinsing the latter with hexane; mechanical replacing of hydro-alcohol with hexane should allow moderating the following desolventizing conditions.

MATERIAL AND METHODS

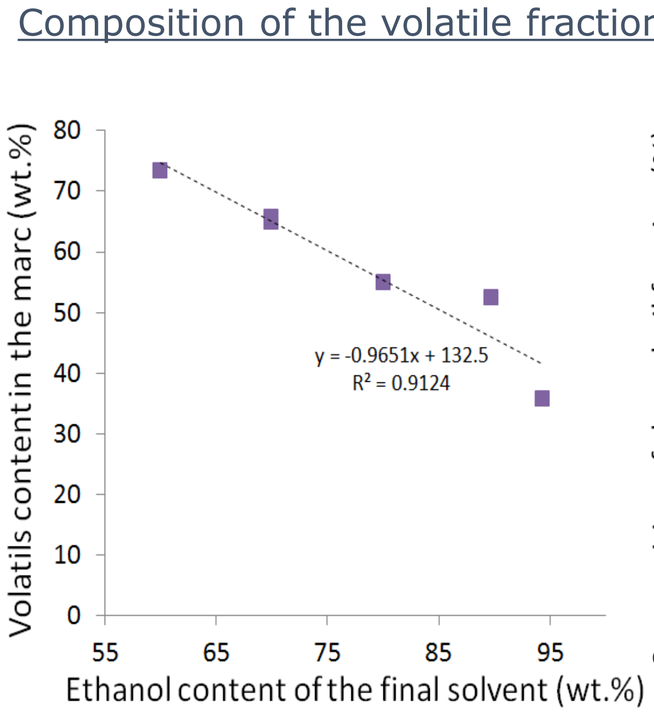


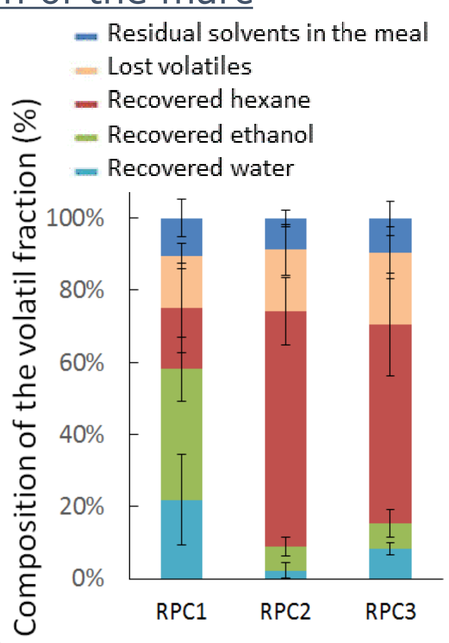
The press cake was first extracted by a succession of washing-filtration steps by solvents in an agitated Nutsche filter (POPE Scientific Inc., USA). Three extraction sequences were compared:

- **RPC1**: 3x(70 wt.% EtOH) then 2x(hexane);
- **RPC2**: 3x(70 wt.% EtOH) then 1x(96 wt.% EtOH) then 2x(hexane);
- **RPC3**: 3x(90 wt.% EtOH) then 1x(96 wt.% EtOH) then 2x(hexane).

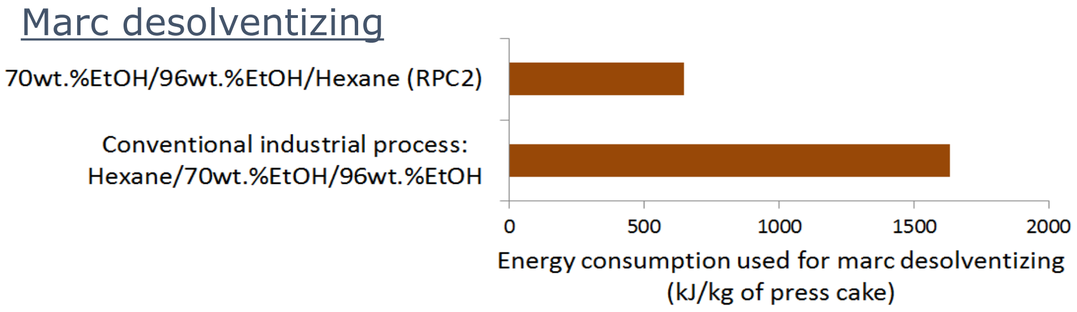
RESULTS

Composition of the volatile fraction of the marc





Marc desolventizing



The residual solvent content of the marc extracted by ethanol was higher than the one of marc extracted by hexane in same conditions of filtration. Furthermore, the solvent retention in the marc increased with the water content of ethanol.

The volatile fraction of the final marc extracted by the RPC1 sequence contained more ethanol and water than the one extracted by the RPC2 sequence.

With the RPC2 sequence, desolventization would require just 40% of energy of a regular processing (hexane/70wt.%EtOH/96wt.%EtOH). The difference is explained by:

- less number of desolventizing steps (one in this alternative process instead of two in the conventional process: after both hexane and ethanol extractions),
- less quantity of solvent to evaporate,
- and a lower energy required to remove hexane than hydroethanol.

Meal quality

		Oil content (% on DM)	Protein content (% on DDM)	Protein solubility (KOH - %)	Glucosinolate content (µMol/g DDM)
Rapeseed press cake		14	44	na	42
Final rapeseed meal	RPC1	4	54	77	3.8
	RPC2	1	56	74	3.2
	RPC3	1	52	80	27.6

(DM: Dry Matter; DDM: De-oiled Dry Matter)

The increasing of water content of ethanol in the first washing steps allowed both increasing the protein content and reducing the glucosinolates content in the final meal. Final washes by 96% ethanol then hexane did not significantly impact the protein and glucosinolate contents of the meal.

CONCLUSION

The implementation of an intermediate washing with 96 wt.% EtOH between hydroalcoholic and hexane extraction steps reduces both water and others volatile content in the proteins concentrate. As a consequence, desolventizing of RPC obtained by the novel process will require less thermal energy and will be less damaging for proteins, as compared to conventional process.

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