Brassica Carinata & Camelina Sativa: Potential New Biofuel Feedstocks

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Growing world demand for renewable fuels has resulted in an increased interest in alternative, new oilseed crops . Cover crops such as Carinata and Camelina have a relatively short growth cycle and can be cultivated in temperate climate zones in light or medium soils. For these reasons, they are considered as promising new biofuels feedstocks.

Brassica Carinata – seeds composition:

Moisture (%)	**5 – 12**
Oil (%)	**40.2 – 52**
Protein (%)	**18.7 – 28.3**
Crude fiber (%)	**6.5 – 9.2**
Others (%)	**8.6 – 22.8**

Camelina Sativa – seeds composition:

Moisture (%)	**4.2 – 6.8**
Oil (%)	**30.6 – 49.7**
Protein (%)	**18.1 – 22.3**
Crude fiber (%)	**9.7 – 15.3**
Others (%)	**3.7 – 18.1**

SEEDS PROCESSING

Oil extraction from Brassica Carinata and Camelina Sativa is straightforward and similar to oil extraction from rape and canola seeds.

One possible crushing route consists of the mechanical pre-pressing of the seeds followed by a solvent extraction. This process route gives max. oil recovery but requires a higher investment compare to a full mechanical (solvent-free) oil extraction. Main drawback of full pressing is the lower oil yield as the press cake still contains ±8% residual oil.

SEEDS PREPARATION → **PRE-PRESSING** (60 – 65% of total oil) or **FULL PRESSING** (88 – 92% of total oil) → **SOLVENT EXTRACTION** (35 – 40%)of total oil → **BLENDING** → **TO REFINING**

- ***Flaking - cooking***
- ***20 -22% oil in cake***
- ***8 – 12% oil in cake***
- **1 – 2 % oil in meal**
- **pre-pressed and solvent extracted oil**

Crude oil quality

Parameter	Brassica Carinata			
	Full pressed	Pre-pressed	Extracted	Blend (65/35)
FFA (% C18:1)	0.5 - 5	0.5 - 2	2.5 - 7.45	2.3 - 3.4
P (ppm)	400 - 760	140 - 200	900 - 1500	500
Fe (ppm)	1.5	1.6	11	1.6
Ca (ppm)	347	35	510	74
Mg (ppm)	130	14	190	45
Sum metals (ppm)	734	73	1086	220

Parameter	Camelina Sativa			
	Pressed	First press	Second press	Extracted
FFA (% C18:1)	2.32	0.76 - 2.3	1.3	2.54
P (ppm)	81	11.5 - 20	560	821
Fe (ppm)	1	4	2.9	2.1
Ca (ppm)	58	12	203	117
Mg (ppm)	24	6	153	68
Sum metals (ppm)	92	34	485	376

OIL REFINING

Refining of Carinata and Camelina oil is very similar to the refining of Canola/Rapeseed oil. Nitrogen, Sulphur and Chlorine content in these crude oils is usually low. Hence, pre-treatment for biofuels production mainly focuses on the removal of P and metals. FFA stripping is only needed when the refined oil is intended for biodiesel, not when used for HVO production. Final color is not a quality parameter for these applications.

CRUDE OIL → **DEGUMMING** → **WATER WASHING** → **ADSORPTION** → **FFA REMOVAL**

- Water/Acid or Enzymatic degumming
- Silica treatment
- Bleaching (Single/ Double)
- Only for Biodiesel

Pre-treated HVO Feedstock Characteristics (Specs HVO Providers)

Provider:	1	2	3	4
FFA (% - max)	<5 (<20)	<95	<20	<20
P (ppm - max)	3	3	1	2
Total Metals (ppm - max)	10	10	10	5
S (ppm - max)	100	20		30
N (ppm - max)	350	200	N.S.	100
Cl (ppm - max)	50	5		5

Quality Parameters of Pre-treated Carinata and Camelina oils

	Brassica Carinata			
	Crude (extracted)	Water Degummed	Bleached	Deodorized
FFA (% C18:1)	4.4	3.4	3.4	0.06
P (mg/kg)	1100 - 1500	200 - 300	0.9 - 5	<2
Sum metals (mg/kg)	1090	300	1.5 - 8	<5
N (mg/kg)		21 - 30	28	
S (mg/kg)		44 - 68	33	
Cl (mg/kg)		<1.3	<1.3	

	Camelina Sativa			
	Crude (pressed)		Bleached	Deodorized
FFA (% C18:1)	0.6		0.75	0.04
P (mg/kg)	9.4		<0.5	<0.5
Sum metals (mg/kg)	27.7-37		<5	<2
N (mg/kg)				
S (mg/kg)				
Cl (mg/kg)				

CONCLUSIONS

Oil extraction from Carinata and Camelina seeds and refining of the crude oil can be done with known, well established processes. Biodiesel/HVO feedstock specifications can be achieved by a straightforward degumming and bleaching; no complex purification process is needed.

Hence, whether or not Carinata and Camelina oil will effectively become meaningful biofuel feedstocks will depend on crop cultivation-related parameters; such as the availability of enough land, sensitivity of the crop and achievable seed/oil yield per hectare.