

**PRODUCTION OF BIODIESEL FUEL FROM UNCONVENTIONAL RAW MATERIALS****BIODĪZEĻDEGVIELAS IEGŪŠANA NO NETRADICIONĀLĀM IZEJVIELĀM**

Maija Strēle, Rasma Seržane, Māra Jure  
Riga Technical University  
Mārcis Pētersons  
Agenskalns State Gymnasium

**Kopsavilkums**

Veikti pētījumi par biodīzeļdegvielas iegūšanu no netradicionālām izejvielām: reņģu eļļas, iegūtas no šprotu ražošanas atkritumiem, un etilspirta-izopropilspirta maisījuma (Mosstanol L), kuru lieto kā lētu šķīdinātāju. Iegūti reņģu eļļas metil- un etilesteri; izmantojot Mosstanol L, iegūti rapšu eļļas etilesteri.

Environment friendly alternative to fossil fuel is production of biodiesel from renewable raw materials, e.g., vegetable oils. Even larger ecological effect can be obtained, using oils, which are by-products of food processing and usually pass into waste dumping-ground or sewage.

Present investigations are devoted to production of biodiesel from fish oil, obtained from sprats production waste. As it is known, Baltic pilchard oil contains 33.8 % saturated, 31.1 % monosaturated and 35.1 % polyunsaturated fatty acids. Methyl- and ethylesters of fatty acids from Baltic pilchard oil were prepared by classical method – 2 hours heating with alcohols at their boiling temperature in the presence of alkali catalysts - sodium hydroxide or potassium hydroxide. After settling from lower glycerol layer, methyl- and ethylesters of fatty acids (FAME, FAEE) were separated with yields 90 % and 89 % (m/m), correspondingly.

Quality indices of raw material - Baltic pilchard oil -, as well as obtained FAME and FAEE were determined (Table 1).

Table 1

Quality of Baltic pilchard oil and its methyl- and ethylesters

Property	Unit	Baltic pilchard oil	FAME	FAEE	Limits LVS EN 14214
Kinematic viscosity at 40 °C	mm <sup>2</sup> /s	26.2	5.0	4.96	3.5-5.0
Flash point	°C	-	101	-	≥ 101
Peroxide value	meq O <sub>2</sub> /kg	2.94	2.0	1.90	≤ 50
Acid value	mg KOH/g	3.1	0.4	0.43	≤ 0.50
Iodine value	g I <sub>2</sub> /100g	150.8	-	161.8	≤ 120
Total contamination	mg/kg	-	0.9	0.2	≤ 24
Water content	mg/kg	3510	280	310	≤ 500

It turned out that iodine value of Baltic pilchard oil (150.8 g I<sub>2</sub>/100 g) is higher than it is characteristic for vegetable oils used for production of biodiesel, e.g., iodine value of rapeseed oil is 115, soybean and sunflower oils – approx. 130 g I<sub>2</sub>/100 g. In order to produce biodiesel with iodine value ≤120 (as it is envisaged by standard LVS EN 14214) some vegetable oil containing many saturated fatty acids, e.g., palm oil (iodine value 35-61 g I<sub>2</sub>/100 g) should be added to Baltic pilchard oil.

Second unconventional raw material which we tested for production of biodiesel was comparatively cheap mixture of absolute alcohols – *Mosstanol L*, by-product of synthetic gasoline, solvent consumed for production of automotive performance fluids such as screen wash, de-icers, break cleaners etc. This mixture of alcohols contained 60% ethanol and 39.7% isopropanol.

Transesterification of rapeseed oil was carried out at room temperature by 2 hours stirring in the presence of potassium hydroxide (2% m/m to oil mass). It seems that only ethanol is consumed for transesterification at such conditions (Table 2); similar suggestions can be found also in literature.

Yield of esters depends from excess of alcohols; better results were obtained for 1:6-1:8 mole proportions of oil:ethanol; the best result was in case of proportion 1:7.

Table 2

Mole proportion oil:ethanol	Yield, %, calculated from oil mass	Properties of obtained fatty acids esters		
		Kinematic viscosity at 40 °C, mm <sup>2</sup> /s	Density at 20 °C, g/cm <sup>3</sup>	Alcohol content, % (m/m)
1:3.3	49.0	4.17	0.868	7.6
1:5	84.1	4.19	0.867	7.8
1:6	91.6	4.29	0.868	7.5
1:7	93.1	3.90	0.867	8.4
1:8	94.3	4.00	0.868	11.2
1:9	94.6	3.87	0.865	12.6

### CONCLUSIONS

Application of unconventional raw materials for production of biodiesel was investigated:

- Methyl- and ethylesters of Baltic pilchard oil, produced from sprats production waste, were obtained with 89-90% yield. Determined quality indices of esters correspond to requirements of LVS EN 14214; nevertheless iodine value is too high.
- Esters of rapeseed oil were obtained using as transesterification agent mixture of ethanol and isopropanol - *Mosstanol L*. It turned out that mainly ethylesters are formed in this process.

Mārcis Pētersons, Agenskalns State Gymnasium, Lavīzes 2a, Rīga, LV-1002, 9771798