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Thermophysical and rheologic properties of biooil samples

Termofyzikálne a reologické vlastnosti vzoriek biomazív

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Abstract

This article deals with thermal properties of selected biooils (Plahyd S – biooil No1 and Plahyd N – biooil No2) and rheologic properties of rapeseed oil. Plahyd S is a synthetic, rapidly biodegradable fluid which is based on sustainable raw materials. It is exceptionally suitable for applications in mobile and stationary hydraulic systems. Plahyd N is multigrade hydraulic oil based on rapeseed oil used in agricultural and construction machinery. For thermal parameters measurements was used Hot wire method. The experiment is based on measuring of the temperature rise vs. time evaluation of an electrically heated wire embedded in the tested material. The thermal conductivity is derived from the resulting change in temperature over a known time interval. Dependency of material resistance against the probe rotation was used at measurement of rheologic properties with instrument viscometer Anton Paar DV-3P. For two samples of biooils – Plahyd N and Plahyd S were determined basic thermophysical parameters – thermal conductivity, thermal diffusivity and volume specific heat. For each biooil samples were made two series of measurements. In the first series were measured thermal conductivity and thermal diffusivity at constant room temperature 20 °C. Every thermophysical parameter was measured 10 times for each sample. The results were statistically processed. For biooil No1 thermal conductivity was 0.325 $W*m^{-1}.K^{-1}$, it was higher value than we obtained for biooil No2 – 0.224 $W*m^{-1}.K^{-1}$. The similar results were obtained for thermal diffusivity of biooil No1 $2.140.10^{-7}$ m^2*s^{-1} and biooil No2 $2.604.10^{-7}$ $m^{2*}s^{-1}$. For samples with constant temperature were calculated basic statistical characteristics as: standard deviation for λ – biooil No1 (±0.056 $W*m^{-1*}K^{-1}$) and biooil No2 (± 0.054 $W*m^{-1*}K^{-1}$); probable error of the arithmetic average for λ – biooil No 1 (±0.012 $W*m^{-1*}K^{-1}$) and biooil No 2 (±0.005 $W*m^{-1*}K^{-1}$); relative probable error in % for λ – biooil No1 (±3.69 %) and biooil No2 (±2.23 %). The same statistical characteristics were calculated for thermal diffusivity. In the second series of measurements were measured relations of thermal conductivity and thermal diffusivity to the temperature in temperature range (20 – 29) °C. From results was evident that all measured dependencies are nonlinear. For both thermophysical parameters were obtained polynomial functions of the second degree described by the polynomial coefficients. Type of function was selected according to statistical evaluation based on the coefficient of determination for every thermophysical parameter graphical dependency. In temperature dependency of rapeseed oil dynamic viscosity was used decreasing exponential function, which is in accordance with Arrhenius equation. The results obtained by the implementation of thermophysical and rheologic measurements on samples of biooils could be compared with the values presented in the literature.

Keywords: biooils, dynamic viscosity, temperature, thermal conductivity, thermal diffusivity

Abstrakt

Článok sa zaoberá tepelnými vlastnosťami vybraných biomazív (označených ako Plahyd S – biomazivo č. 1 a Plahyd N – biomazivo č. 2) a reologickými vlastnosťami repkového oleja, ktorý je základnou zložkou pri výrobe skúmaných biomazív. Plahyd S je syntetická rýchlo biodegradovateľná tekutina, ktorá je vyrobená z obnoviteľných surovín. Tento typ biomaziva je mimoriadne vhodný pre použitie v mobilných a stacionárnych hydraulických systémoch. Plahyd N je hydraulický olej vyrobený na báze repkového oleja a je vhodný pre použitie v poľnohospodárskych a stavebných strojoch. Na meranie termofyzikálnych parametrov biomazív bola použitá metóda horúceho drôtu. Meranie touto metódou je založené na analýze časového priebehu teploty v okolí horúceho drôtu, ktorý predstavuje líniový zdroj tepla umiestnený vo vzorke testovaného materiálu. Tepelná vodivosť sa určí z výsledkov zmien teploty vo vymedzenom časovom intervale. Pri meraní reologických vlastností – dynamickej viskozity bol použitý viskozimeter Anton Paar DV-3P, ktorý využíva závislosť odporu materiálu voči otáčaniu sondy. Pre dve vzorky biomazív – Plahyd N and Plahyd S boli získané základné termofyzikálne parametre ako sú: tepelná vodivosť a teplotná vodivosť. Pre každú zo skúmaných vzoriek boli realizované dve série meraní. V prvej sérii boli merané tepelná a teplotná vodivosť pri konštantnej laboratórnej teplote 20 °C, pričom každý termofyzikálny parameter bol meraný pre každú vzorku 10 krát. Všetky namerané hodnoty boli štatisticky spracované. Pre biomazivo č. 1 bola zistená tepelná vodivosť 0,325 W*m^{-}1*K^{-1}, čo je vyššia hodnota ako v prípade vzorky biomaziva č. 2 0,224 W*m^{-}1*K^{-1}. Podobné výsledky boli dosiahnuté aj v prípade teplotnej vodivosti, kde biomazivo č. 1 vykazovalo teplotnú vodivosť 2,140.10^{-7} m^{2*}s^{-1} a pre biomazivo č. 2 bola zistená hodnota 2,604.10^{-7} m2*s^{-1}. Pre vzorky merané pri konštantnej teplote boli vypočítané základné štatistické charakteristiky ako: štandardná odchýlka pre λ – biomazivo č. 1 (±0.056 W.m^{-1}.K^{-1}) a pre biomazivo č. 2 (±0.054 W.m^{-1}.K^{-1}); pravdepodobná chyba aritmetického priemeru pre λ – biomazivo č. 1 (±0.012 W.m^{-1}.K^{-1}) a pre biomazivo č. 2 (±0.005 W.m^{-1}.K^{-1}); relatívna pravdepodobná chyba v % pre λ – biomazivo č. 1 (±3.69 %) a pre biomazivo č. 2 (±2.23 %). Identické štatistické charakteristiky boli vypočítané pre hodnoty teplotnej vodivosti. V druhej sérii boli realizované merania závislostí tepelnej a teplotnej vodivosti od teploty v teplotnom intervale (20 – 29) °C. Z prezentovaných výsledkov je zrejmé, že všetky sledované závislosti vykazujú nelineárny charakter. Pre obe závislosti termofyzikálnych parametrov boli použité polynomické funkcie druhého stupňa. Typ funkcie pre každú grafickú závislosť bol určený na základe štatistického vyhodnotenia na základe hodnoty koeficientu determinácie. V závislosti dynamickej viskozity od teploty pre vzorku repkového biooleja bola identifikovaná klesajúca exponenciálna funkcia, čo je v súlade s Arrheniovou rovnicou. Výsledky získané aplikáciou termofyzikálnych a reologických meracích metód na vzorky biomazív a biooleja sú zrovnateľné s výsledkami prezentovanými v literatúre.

Kľúčové slová: biomazivá, dynamická viskozita, teplota, tepelná vodivosť, teplotná vodivosť

Detailný abstrakt

Prezentovaný článok sa zaoberá problematikou merania tepelných vlastností vybraných biomazív (označených ako Plahyd S – biomazivo č. 1 a Plahyd N – biomazivo č. 2) a tiež problematikou merania vybraných reologických parametrov repkového oleja, ktorý je základnou zložkou pri výrobe skúmaných biomazív. Plahyd S je syntetická rýchlo biodegradovateľná tekutina, ktorá je vyrobená z obnoviteľných surovín. Tento typ biomaziva je mimoriadne vhodný pre použitie v mobilných a stacionárnych hydraulických systémoch. Plahyd N je hydraulický olej vyrobený na báze repkového oleja a je vhodný pre použitie v poľnohospodárskych a stavebných strojoch. Na meranie termofyzikálnych parametrov biomazív bola použitá metóda horúceho drôtu. Meranie touto metódou je založené na analýze časového priebehu teploty v okolí horúceho drôtu, ktorý predstavuje líniový zdroj tepla umiestnený vo vzorke testovaného materiálu. Tepelná vodivosť sa určí z výsledkov zmien teploty vo vymedzenom časovom intervale. Pri meraní reologických vlastností – dynamickej viskozity bol použitý viskozimeter Anton Paar DV-3P, ktorý využíva závislosť odporu materiálu voči otáčaniu sondy. Pre dve vzorky biomazív – Plahyd N and Plahyd S boli získané základné termofyzikálne parametre ako sú: tepelná vodivosť a teplotná vodivosť. Pre každú zo skúmaných vzoriek boli realizované dve série meraní. V prvej sérii boli merané tepelná a teplotná vodivosť pri konštantnej laboratórnej teplote 20 °C, pričom každý termofyzikálny parameter bol meraný pre každú vzorku 10 krát. Všetky namerané hodnoty boli štatisticky spracované. Pre biomazivo č. 1 bola zistená tepelná vodivosť 0,325 $W*m^{-}1*K^{-1}$, čo je vyššia hodnota ako v prípade vzorky biomaziva č. 2 0,224 $W*m^{-}1*K^{-1}$. Podobné výsledky boli dosiahnuté aj v prípade teplotnej vodivosti, kde biomazivo č. 1 vykazovalo teplotnú vodivosť $2,140.10^{-7}$ $m^{2*}s^{-1}$ a pre biomazivo č. 2 bola zistená hodnota $2,604.10^{-7}$ $m2*s^{-1}$. Pre vzorky merané pri konštantnej teplote boli vypočítané základné štatistické charakteristiky ako: štandardná odchýlka pre λ – biomazivo č. 1 (±0.056 $W.m^{-1}.K^{-1}$) a pre biomazivo č. 2 (±0.054 $W.m^{-1}.K^{-1}$); pravdepodobná chyba aritmetického priemeru pre λ – biomazivo č. 1 (±0.012 $W.m^{-1}.K^{-1}$) a pre biomazivo č. 2 (±0.005 $W.m^{-1}.K^{-1}$); relatívna pravdepodobná chyba v % pre λ – biomazivo č. 1 (±3.69 %) a pre biomazivo č. 2 (±2.23 %). Identické štatistické charakteristiky boli vypočítané pre hodnoty teplotnej vodivosti. V druhej sérii boli realizované merania závislostí tepelnej a teplotnej vodivosti od teploty v teplotnom intervale (20 – 29) °C. Z prezentovaných výsledkov je zrejmé, že všetky sledované závislosti vykazujú nelineárny charakter. Pre obe závislosti termofyzikálnych parametrov boli použité polynomické funkcie druhého stupňa. Typ funkcie pre každú grafickú závislosť bol určený na základe štatistického vyhodnotenia na základe hodnoty koeficientu determinácie. V závislosti dynamickej viskozity od teploty pre vzorku repkového biooleja bola identifikovaná klesajúca exponenciálna funkcia, čo je v súlade s Arrheniovou rovnicou. Výsledky získané aplikáciou termofyzikálnych a reologických meracích metód na vzorky biomazív a biooleja sú zrovnateľné s výsledkami prezentovanými v literatúre.

Výsledky získané v rámci merania termofyzikálnych a reologických parametrov sú vhodným príspevkom k rozšíreniu poznatkov o vlastnostiach biomazív a sú využiteľné v rôznych pratických aplikáciách. Článok poukazuje zároveň na možnosti implementácie použitých metód merania termofyzikálnych a reologických parametrov na vzorky biomazív. Získané výsledky pre merané vzorky biomazív je možné porovnať iba rámcovo s hodnotami uvádzanými v literatúre, nakoľko biomazivá disponujú značne variabilným zloženým, z čoho vyplýva aj variabilita ich fyzikálnych vlastností. Na základe prezentovaných výsledkov merania reologických a termofyzikálnych parametrov je zrejmé, že teplota je jedným z významných faktorov ovplyvňujúcich fyzikálne vlastnosti biomazív, nakoľko tieto prechádzajú v procesmi, ktoré sú charakteristické zmenami teploty. Z vyššie uvedených dôvodov možno teplotu považovať za jeden z najvýznamnejších faktorov, ktoré ovplyvňujú kvalitu biomazív.

Introduction

The article deals with selected biooils thermophysical and rheologic properties. In this contribution are presented basics characteristics of measured biooils, theoretical principle of simplified Hot Wire (HW) method and results of measurements.

Biooils are materials which have very specific composition with variable chemical and physical properties according to the purpose of usage.

Knowledge of physical properties of bio based materials including biooils has a decisive importance for the realization of many technological processes, especially for monitoring of their quality (Božiková, 2005, 2007), (Hlaváč, 2009, 2010). Thermophysical parameters and in case of liquid materials also rheologic parameters are significant characteristics which can be used for improving of the technologic processes, thermal processing of bio-based materials and their storage conditions. Presented facts show that thermophysical and rheological research applied on bio-based materials used in industry is very important because materials like biooils go through the thermal manipulation during processing to final products, storage and usage (Božiková, Hlaváč, 2010).

Materials and methods

Selected characteristics of measured biooils are described in the following text. Plahyd S is a synthetic, rapidly biodegradable fluid based on sustainable raw materials. It is exceptionally suitable for applications in mobile and stationary hydraulic systems, for which a rapidly biodegradable hydraulic oil according to VDMA 24 568, HEES is recommended, especially if there is an environmental hazard to the ground, ground water or the surface waters due to leakage (construction, water resources management, agriculture, forestry).

Plahyd N is environmentally friendly multigrade hydraulic oil based on rapeseed oil (HETG) for agricultural and construction machinery, meeting all requirements in accordance with VDMA 24568. With respect to its viscosity position, Plantohyd 40N belongs to engine oil SAE class 5W-20 and is recommended for hydraulic systems that require the use of SAE 5W, SAE 10W, SAE 15W, SAE 20W, SAE 20W-20 engine oils or hydraulic oils in accordance with ISO VG 32, VG 46, VG 68. (Fuchs, 2012).

Measuring of thermal parameters was performed by simplified transient Hot Wire (HW) technique. The simplified HW method is technique based on the measurement of the temperature rise of a linear heat source (hot wire) embedded in the tested material (Assael – Antoniadis - Wu, 2008; Persons – Mulligan, 1978; Kadjo – Garnier – Maye – Martemianov, 2008). For an infinitely long metallic wire (length/radius ratio >>200) heated at time t > 0 with a constant heat flux per length unit q and immersed in an infinite homogeneous medium (thermal conductivity and diffusivity: λ and a with uniform initial temperature, the temperature rise ΔT(t) of the wire is given by equation (1) (Carslaw – Jaeger, 1959):

$$\Delta T(t) = \frac{q}{4\pi\lambda} \ln \frac{4F_0}{C} \qquad (1)$$

with $C = e^{\gamma} = 1.781$ where γ is Euler's constant ($\gamma = 0.5772$) and F_0 is the Fourier number defined by

$$F_0 = \frac{a\,t}{r_0^2} \qquad (2)$$

Equation (1) is the analytical solution of an ideal thermal conductive model valid for $F_0 >> 1$ and without convective transfers (Healy – De Groot – Kestin, 1976; Wakeham - Nagashima, 1991; Tavman, 1996). From this ideal model and with known q values, the thermal conductivity can be calculated by equation (3)

$$\lambda = \frac{q}{4\pi}\left(\frac{dT}{d(\ln t)}\right)^{-1} \qquad (3)$$

Where dT/d(ln t) is a numerical constant deduced from experimental data for t values which satisfy the condition $F_0 >> 1$. For practical applications of the HW method, wire and material sample dimensions, among other ideal model hypothesis, are finite and the deviations from the ideal model have then to be evaluated. In fact, the e(t) answer to the wire heating ΔT(t) resultant of the Joule effect due to an electrical current.

$$R(t) = R_0\left(1 + \beta_0\left(T(t) - T_0\right)\right) \qquad (4)$$

where R(t) – is the instantaneous electrical resistance of the wire, R_0 – is the resistance of the wire at the T_0 reference temperature, and β_0 is the temperature coefficient of the wire at 22 °C. Taking into account (3) and (4), the thermal conductivity λ can be calculated as follows:

$$\lambda = \frac{q\,R_0\,\beta_0\,i}{4\pi}\left(\frac{d\,e(t)}{d(\ln t)}\right)^{-1} \qquad (5)$$

where de(t)/d(ln t) is a numerical constant deduced from the experimental data and from the linear part of the e(t) = f (ln(t)) curve.

Thermal diffusivity *a* characterizes the velocity of the temperature field equalisation in material during non-stationary process and it can be calculated from time-temperature function obtained during measurement process. The definition of thermal diffusivity is expressed by formula $a = \lambda/(c\,\rho)$, where λ - is thermal conductivity, *c* – is specific heat and *ρ* – is density of material.

The next part of research was focused on measuring of dynamic viscosity, as one of the most important rheologic parameters and it can be defined as the resistance of a fluid to flow. The physical unit of dynamic viscosity in SI units is Pa.s. Due to the low viscosity values of liquids is more often used unit mPa.s. Viscosity of materials changes with the temperature. The difference in the effect of temperature on viscosity of fluids and gases can be related to the difference in their molecular structure. Viscosity of most of the liquids decreases with increasing of the temperature. The relation between viscosity and the temperature can be characterized by an Arrhenius type equation (6)

$$\eta = \eta_0\, e^{-\frac{E_A}{RT}} \qquad (6)$$

where η_0 is reference value of dynamic viscosity, E_A is activation energy, R is gas constant and T is absolute temperature (Figura and Teixeira, 2007). Liquid molecules are closely spaced with strong cohesive forces between them. The temperature dependence of viscosity can also be explained by cohesive forces between the molecules (Munson et al., 1994). As temperature increases, these cohesive forces between the molecules decrease and flow became freer. As a result viscosities of liquids decrease as temperature increases. In liquids, the intermolecular (cohesive) forces play an important role (Sahin and Sumnu, 2006).

Measuring of dynamic viscosity was performed by digital viscometer Anton Paar (DV-3P). Principle of measuring by this viscometer is based on dependency of sample resistance against the probe rotation. Probe with signification R2 was used in our measurements. Relation of dynamic viscosity to the temperature can be described by decreasing exponential function (7):

$$\eta = A\, e^{-B\left(\frac{t}{t_o}\right)} \qquad (7)$$

where t is temperature, t_o is 1 °C, A, B are constants dependent on kind of material.

Results and discussion

In the group of biooils were performed measurements for two different samples produced by firm Fuchs. Specifically were measured biooil samples as: Plahyd N and Plahyd S. For both samples were determined basic thermophysical parameters – thermal conductivity and thermal diffusivity. For each biooil sample were made two series of measurements. In the first series were measured thermal conductivity and thermal diffusivity at the constant temperature, which was same with the room temperature 20 °C. Thermal stabilization of the samples was carried out 24 hours before the actual measurement. Every thermophysical parameter was measured 10 times for each sample.

The results were statistically processed (Table 1 and 2). We have calculated arithmetic averages of thermal conductivity and thermal diffusivity, as well as, basic statistical characteristics as: standard deviation, probable error of arithmetic average, relative probable error. For biooil No1 thermal conductivity were 0.325 W*m^{-1}*K^{-1}, it was higher value than we obtained for biooil No2 – 0.224 W*m^{-1}*K^{-1}. The similar results were obtained for thermal diffusivity of biooil No1 2.140.10^{-7} m^{2}*s^{-1} and biooil No2 2.604.10^{-7} m^{2}*s^{-1}. For samples with constant temperature were calculated basic statistical characteristics as: standard deviation for λ - biooil No1 (±0.056 W*m^{-1}*K^{-1}) and for sample of biooil No2 (±0.054 W*m^{-1}*K^{-1}); probable error of the arithmetic average for thermal conductivity λ was: biooil No 1 (±0.012 W*m^{-1}*K^{-1}) and for sample of biooil No 2 (±0.005 W*m^{-1}*K^{-1}). Relative probable error in % was for λ - biooil No1 (±3.69 %) and biooil No2 (±2.23 %). The same statistical characteristics were calculated for thermal diffusivity and results of this calculation are showed in the first part of Table 2.

In the second series of measurements were measured relations of thermal conductivity and thermal diffusivity to the temperature in temperature range (20 – 29) °C.

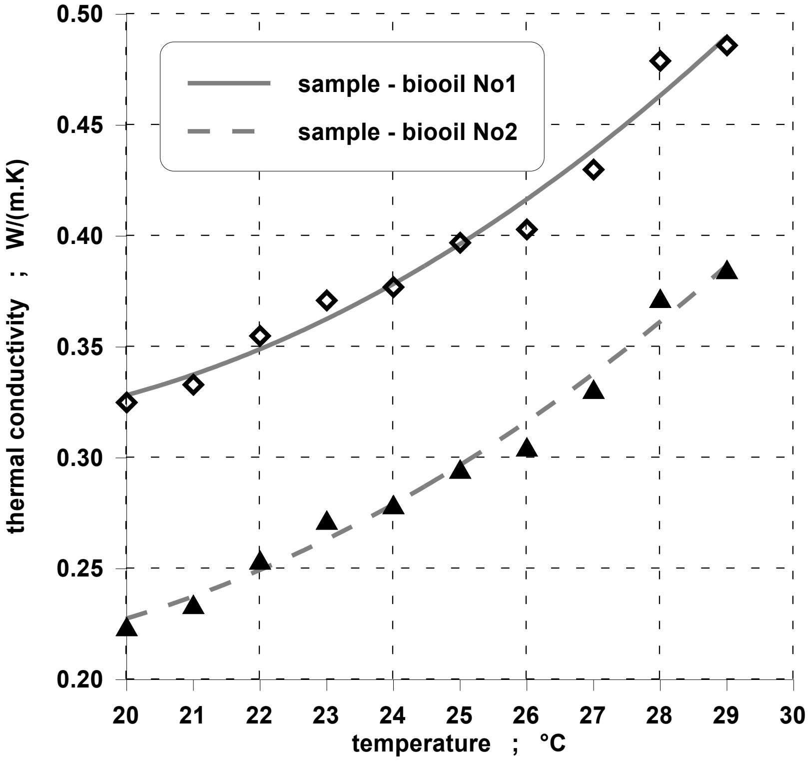

Figure 1 Relation of thermal conductivity to the temperature for biooil samples

Obrázok 1 Závislosť tepelnej vodivosti od teploty pre vzorky biomazív

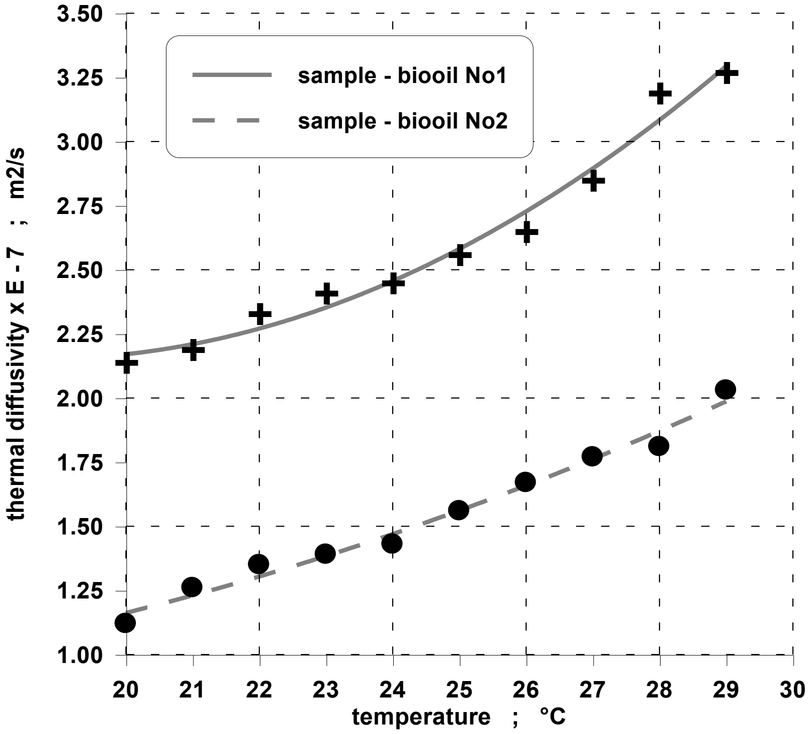

Figure 2 Relation of thermal diffusivity to the temperature for biooil samples

Obrázok 2 Závislosť teplotnej vodivosti od teploty pre vzorky biomazív

Results are showed on Figure 1 and Figure 2. The statistical evaluations of thermal conductivity and diffusivity graphical dependencies are presented in the second part of Table 1 and Table 2. From presented results is evident that all measured dependencies are nonlinear. For both thermophysical parameters were obtained polynomial functions of the second degree with polynomial coefficients and coefficients of determination in Table 1, 2. In all cases were the coefficients of determination of the second degree relatively high not less than the relevant value 0.95. For samples of biooils No1 and No2 was also detected volume specific heat, but it was calculated from the measured values of thermal conductivity and thermal diffusivity. The volume specific heat for biooil No1 had value 0.154 .10^7 J*m^{-3}*K^{-1} and for sample No2 was obtained value 0.152 .10^7 J*m^{-3}*K^{-1}.

Table 1 Thermal conductivity of biooils

Tabuľka 1 Tepelná vodivosť biomazív

Statistical evaluation of the measured values for thermal conductivity at 20 °C		
Sample - biooil	**No1**	**No2**
The arithmetic average; W*m^{-1}*K^{-1}	0.325	0.224
Standard deviation; W*m^{-1}*K^{-1}	±0.056	±0.054
Probable error; W*m^{-1}*K^{-1}	±0.012	±0.005
Relative probable error in %	±3.69	±2.23

Statistical evaluation of thermal conductivity graphical dependencies for temperature range (20 - 29) °C		
Type of function - Polynomial function of the 2nd degree		
The arithmetic average of values t	24.5 °C	
The arithmetic average of values λ; W*m^{-1}*K^{-1}	0.396	0.197
Minimum value; W*m^{-1}*K^{-1}	0.325	0.182
Maximum value; W*m^{-1}*K^{-1}	0.486	0.224
Polynomial Coefficients		
degree 0	0.599	0.295
degree 1	-0.035	0.224
degree 2	0.599	0.385
Coefficient of Determination (R-squared)		
degree 0	0	0
degree 1	0.954	0.953
degree 2	0.976	0.988

Table 2 Thermal diffusivity of biooils

Tabuľka 2 Teplotná vodivosť biomazív

Statistical evaluation of the measured values for thermal diffusivity at 20 °C		
Sample - biooil	**No1**	**No2**
The arithmetic average; x 10^{-7} m^{-2}*s^{-1}	2.140	1.120
Standard deviation; x 10^{-7} m^{-2}*s^{-1}	±0.391	±0.281
Probable error; x 10^{-7} m^{-2}*s^{-1}	±0.057	±0.027
Relative probable error in %	±2.66	±2.41
Statistical evaluation of thermal diffusivity graphical dependencies for temperature range (20 - 29) °C		
Type of function - Polynomial function of the 2nd degree		
The arithmetic average of values t	24.5 °C	
The arithmetic average of values a; x 10^{-7} m^{-2}*s^{-1}	2.140	1.604
Minimum value; x 10^{-7} m^{-2}*s^{-1}	2.140	1.140
Maximum value; x 10^{-7} m^{-2}*s^{-1}	3.270	2.040
Polynomial Coefficients		
degree 0	5.869	1.044
degree 1	-0.399	0.053
degree 2	0.011	0.003
Coefficient of Determination (R-squared)		
degree 0	0	0
degree 1	0.935	0.976
degree 2	0.979	0.983

Table 3 Dynamic viscosity of biooil

Tabuľka 3 Dynamická viskozita biomaziva

Statistical evaluation of dynamic viscosity graphical dependency for temperature range (-10 - 40) °C	
Type of function - Exponential function	
The arithmetic average of values t	15 °C
The arithmetic average of values η; mPa*s	12.059
Minimum value; mPa*s	6.410
Maximum value; mPa*s	19.178
Regresion Coefficients	
Coefficient A; mPa*s	15.668
Coefficient B; -	0.022
Coefficient of Determination (R-squared)	
0.993	

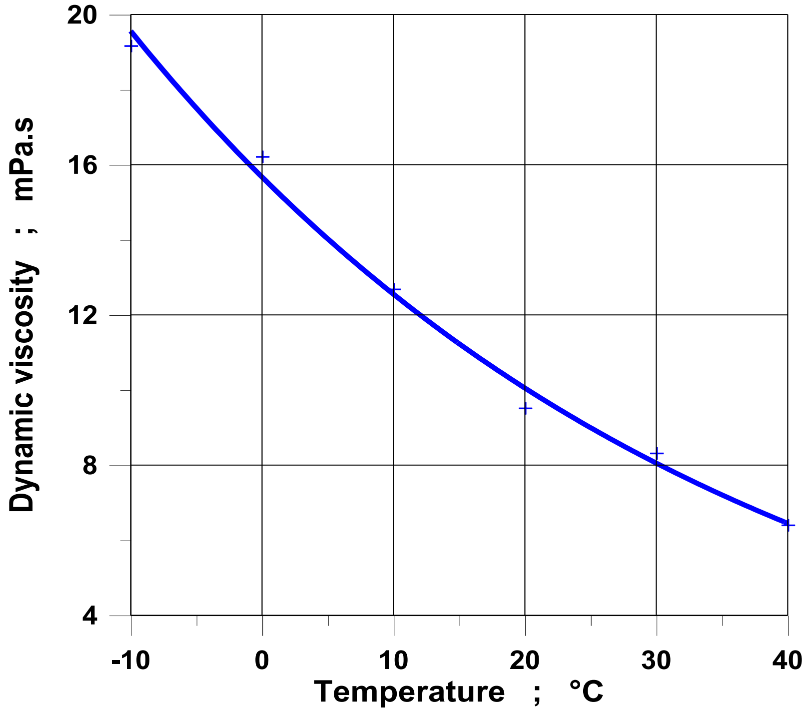

Figure 3 Relation of dynamic viscosity to the temperature for biooil sample

Obrázok 3 Závislosť dynamickej viskozity od teploty pre vzorku biomaziva

Dependency of rapeseed oil dynamic viscosity to the temperature is shown on Fig. 3. Relation had exponential decreasing progress, which can be described by modified Arrhenius equation (7). Same types of dependencies were obtained for food materials as well (Hlaváč, 2009, 2010). Regression coefficients, coefficients of determination, average values, minimum and maximum values are presented in Tab. 3.

Conclusions

Thermal properties, such as temperature, thermal conductivity, thermal diffusivity and volume specific heat characterize heat transfer ability of material, velocity of the temperature equalization and the intensity of the temperature changes in the material. Viscosity, as one of the most important rheologic parameters, is defined as the resistance of a fluid to flow. Accurate values of these properties are critical for practical design as well as theoretical studies and analysis, especially in the fields of heat transfer and thermal processing. The knowledge of thermophysical and rheologic properties of the materials are especially significant in the context of liquid bio-based materials or materials which obtained bio components. These materials are often thermally processed or they are exposed to natural changes of temperature conditions.

The results obtained by the implementation of thermophysical measurement methods on the biooil samples can be compared only with ranges of thermal parameters presented in the literature because of the products variety. Usage of decreasing exponential function for temperature dependency of dynamic viscosity was proved by Arrhenius equation. Nowadays we know many types of biooils which differ in its composition, consistency and its physical properties too.

On the base of presented results from rheologic and thermophysical parameters measurements is clear that it is necessary to have knowledge about physical parameters during temperature changes, because temperature is one of the most important factors which determine quality of bio-based materials.

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