Prediction of oily water separation efficiency by fiber beds using a new filter media property

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Abstract

Bed coalescers are compact, easy to install, automate, and maintain with the ability to achieve high separation efficiencies. They have been increasingly applied in the industry even though their design often requires pilot plant experiments. In this paper, a new wetting property of polymer fibers regarding polar mineral oils was established. This property can be important for selection of filter media for liquid-liquid separation in many industrial applications. Medical oil was selected as the new reference liquid that does not wet the investigated polymers. The lipophilic/lyophobic ratio (LLR) reached values ranging from 3.28 to 18.81 and increased with the increase of the mineral oil polarity measured by the oil neutralization number. The LLR values were in an excellent agreement with the results obtained from the separation efficiency of a steady-state bed coalescer. Thus, simple, fast and inexpensive experiments can replace pilot plant or at least laboratory testing aiming at selecting a polymer for oil separation from wastewater.

Keywords: *oily water; fibre bed; coalescence efficiency; polymer fibre wettability; droplet separation*

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1. INTRODUCTION

Quantity of industrial oily water permanently increases, as well as accidental oil spills. In addition, the emulsion separation has become an important operation in chemical processes for liquid extraction, direct contact heat transfer, effluent treatment and purification of fuels or chemicals. For efficient oil separation from wastewater, it is highly important to identify following parameters: emulsion flow rate, phase ratio and emulsion stability. Even though many separation techniques for oil-in-water emulsions have been proposed [1,2], the steady-state bed coalescence has been proven to be the most suitable. Considering that bed coalescers are compact, easy to install, automate, and maintain, achieving high separation efficiencies, they have been increasingly applied in the industry even though their design often requires pilot plant experiments. However, from the published literature, the most important factors that influence the bed coalescence efficiency have been already investigated in detail, such as: working conditions, fluid flow orientation, bed geometry, bed length and wettability of filter media [1-8].

For decades, the significance of fiber wettability on coalescence efficiency has been investigated [9,10]. The overall view is that wettability is one of the most important or crucial surface properties of filter media, which greatly influences the coalescence outcome as a consequence of attachment and detachment phenomena of droplets in the porous bed [11-14]. Therefore, better understanding of attachment mechanisms affecting the droplet substantially helps in the selection of more efficient filter media for a wide range of industrial applications. Adhesion is difficult to quantify at a fundamental level [15-18]. Hydration forces, hydrophobic interactions, macromolecular bridging, surface roughness, electrical double-layer and van der Waals forces all have possible influences on adhesion [19-21]. Wetting of surfaces involves both surface chemistry and surface geometry. Surface geometry can be considered either as local, such as surface roughness, or it can be considered globally, such as spheres, cylinders or fibres [9,21].

Therefore, differences in surface energy increase due to the surface roughness or chemical nature of material must be distinguished. Smooth fiberglass, stainless steel and ceramic are materials with high surface energy that originates from the chemical nature of these materials. These fibers have lower coalescence efficiency of oil droplets when compared to fibers with low surface energy, such as polymer fibres [9,23-29]. However, glass, stainless steel and ceramic

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fibers are more successful in the coalescence of water droplets dispersed in a continuous organic phase. Due to increase in surface roughness, surface energy and adhesion forces increase, and therefore the coalescence efficiency is then improved [24,29,30].

Studies of surface wettability significantly help in development and selection of more efficient materials for the separation of droplets from a continuous phase. Wettability of solid surfaces can be evaluated using various methods and calculations. Surface wettability is usually expressed by the contact angle formed at the intersection of liquid-solid interface [15,16,21]. For curved surfaces, such as granules or fibers, the adequate methods for determining the contact angle are still not available, especially under dynamic conditions. In these circumstances, it would be useful to establish a property that would indicate the affinity of filter media towards the dispersed phase.

Recently, some research groups proposed to use the modified Washburn equation based on the capillarity force of a fibers media as a satisfactory way to pursuit wettability for complex geometries, such as the fiber bed [31]. According to these authors, the modified Washburn equation provides quantification of the wettability of a filter media by using two liquids: a lipophilic or non-polar as oil, and a hydrophilic or polar liquid such as water and by establishing the L/H ratio. This ratio was developed on the base of capillary penetration of two chosen liquids, water (index w) and oil (index o), by monitoring the rates of penetration into the bed as a function of time, equation 1.

$$\frac{L}{H}=\frac{S_0\eta_0C_\mathrm{w}\rho_\mathrm{w}^2\gamma_\mathrm{w}}{S_\mathrm{w}\eta_\mathrm{w}C_0\rho_0^2\gamma_0} \tag{1}$$

For several decades, the subject of Šećerov Sokolović research group has been the separation of dispersed mineral oils of different properties from a continuous aqueous phase, corresponding to real industrial conditions, using fibre bed coalescence [1,2,6,7]. The investigated oils, in such cases, are mineral oils, which are not non-polar liquids. These oils are products from crude oils, and widely present in wastewater. They are polar with different polarities, which are reflected in some properties, such as the neutralization number, dielectric constant and emulsivity [7]. The polarity of these oils comes from heterogeneous molecules of different structures that contain nitrogen, sulphur, and/or oxygen [2]. The fact that mineral oils with different polarities can be found in oily water has been, up to now, completely ignored in the literature.

The scope of this study was to develop a new property for determination of polymer fibre wettability with polar mineral oils. Lipophilic/lyophobic ratio, LLR, was established based on the modified Washburn's equation. The main goal was to assess how the newly obtained wetting property LLR is correlated with oil droplet separation efficiency using a steady-state bed coalescer. The existence of such a property (LLR) could provide a criterion for selection of the filter material for separation of particular oil droplets without pilot plant experiments.

2. MATERIALS AND METHODS

2. 1. Properties of filter media

Four different polymer fibre materials were investigated: polyurethane (PU), polyethylene terephthalate with two qualities (BA1 and PE) and polypropylene (PP). All the selected polymer materials were waste materials. The PU fibres were obtained from the furniture industry while BA1 fibres were thermo-materials used for stuffing jackets. The PE fibres were from filter media used in kitchen aspirators, and PP fibres were from carpet production. The surface morphology, microstructure, and size of the fibres were characterized by scanning electron microscopy (JEOL, JSM-6460 LV instrument, USA). Densities of investigated materials were (in kg m^{-3}): 741, 1400, 1400 and 900 for PU, BA1, PE and PP, respectively. Melting points of the mentioned filter materials were (in °C): for PU 309, for BA1 and PE 254, and for PP 169. Fibre diameters used in experiments were: for PU 40 ± 4 μm, for BA1 31 ± 2 μm, for PE 38 ± 2 μm, and for PP 36 ± 5 μm.

The bed permeability was calculated from the measured pressure drop across the bed for tap water based on the Darcy law. Density of polymers and bed porosity were measured by the weighing methods, whereas the melting point was obtained using a differential scanning calorimeter (Q20, TA Instruments, USA).

2.2. Properties of tested liquids

Five different mineral oils, without additives, were used in experiments. These mineral oils were a Vojvodinian crude oil (A), two vacuum distillation fractions of the same crude oil (A1, A4), blended petroleum semi product (P1) and medical, white oil (BU). Properties of all investigated oils are presented in Table 1.

The oil properties were characterized by the following methods: density was determined according to ISO 3675, whereas viscosity according to ISO 3104 standard.

Table 1. Properties of investigated oils

	A	A4	A1	P1	BU
Density at 20 °C, kg m^{-3}	916	919	906	879	850
Viscosity at 20 °C, mPa s	123	1207	27	28	12
Neutralization number, g KOH L^{-1}	1.42	1.71	1.13	0.13	0.00
Pour point, °C	-42	-3	-56	+3	-15
Interfacial tension, mN m^{-1}	18.8	30.5	33.8	32.4	51.2
Surface tension, mN m^{-1}	26.56	27.72	28.91	30.16	46.10
Emulsivity, vol.%	99.92	70.00	56.25	54.17	40.00
Mean molar weight, g mol^{-1}	410	520	150	300	420

The neutralization number was measured by the titration method, the pour point of oils was determined according to the ISO 3016 standard method, whereas the interfacial tension measurements were carried out using the du Nouy ring method. The surface tension was obtained by using a stalagmometer. The standard test method ASTM D 2502-67 was used to obtain the mean molar weight. Emulsivity (E) was estimated using a centrifuge technique and the expression:

$$E=\frac{V_{\text{TW}}-V_{\text{FW}}}{V_{\text{TW}}}100 \qquad (2)$$

Deionized water was also used as the test fluid, with the following properties: density 1000 kg m^{-3}, viscosity 1.02 mPa s and the surface tension 72 mN m^{-1}.

2. 3. Experimental set-up and procedure

Two different types of experiments were realized: liquid penetration kinetics into the fiber bed, and oil droplet separation from water using a steady-state bed coalescer.

2. 3. 1. Measurements of liquid penetration kinetics

The liquid penetration experiments were carried out by monitoring the mass of testing liquids transported through the fibre bed by capillary flow over time and recorded as the mass reduction on the balance. Measurements for each of the tested liquids were repeated at least three times. The average value for bed permeability (1.128×10^{-9} m^2) was selected and kept constant for all liquid penetration experiments. The constant permeability (See Supplementary material) was achieved by compression of polymer fibres to the bed length of 1 cm in a Plexiglas tube (44 mm inner diameter) with a perforated bottom. Therefore, by maintaining the bed permeability constant, the bed porosity was also constant (93 %).

The schematic presentation of the experimental set-up is shown in Figure 1. The Plexiglas tube with the fibre bed was fixed to the Jack plate. Underneath the Plexiglas tube, an electronic balance was placed with a transparent glass reservoir containing a test liquid. A digital stopwatch was fixed on the stand and a video camera was placed in a precise location for recording of the values viewed on the digital display of the microbalance and the stopwatch.

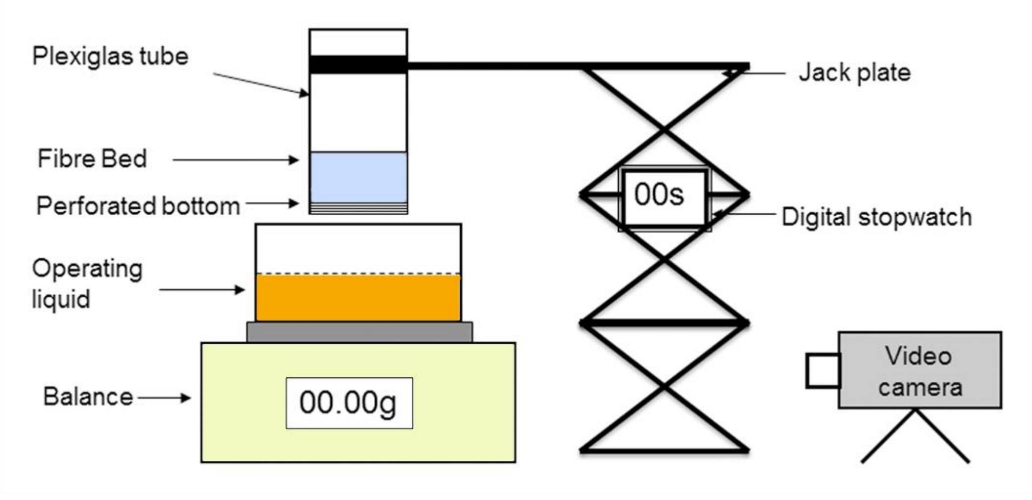

Figure 1. Schematic presentation of the experimental set-up for determination of liquid penetration kinetics

After the preparation, the Plexiglas tube with the fibre media was lowered by the Jack plate until the air-liquid interface was broken and surfaces of the fibre bed and liquid made contact. Due to capillary forces, reduction of the liquid mass was monitored on the balance and recorded by the video camera. L/H ratio was calculated following the methodology of Kulkarni [31]. This study showed that all wetting curves had a linear part that occurred between 0 and 15 s of the experiment.

2. 3. 2. Bed coalescence experiments

The bed coalescence experiments were performed with model oily water on a horizontal mode laboratory-scale bed coalescer, described in detail in our previous investigation [1], operating in a steady-state regime. The inlet oil concentration (500 mg L^{-1}), working temperature (20 °C), bed length (5 cm) and bed permeability ($K_{03} = 1.128\times10^{-9}$ m^2) were constant in all experiments. The experiments were carried out in the velocity range of 19-80 m h^{-1}, and the selected velocity was kept constant for 1 h. Model wastewater was continuously stirred with a stainless steel impeller 45 min prior to the experiments, and during the experiments. The mean inlet droplet size and the size distribution were dependent on properties of the dispersed oil phase and were measured using the Elzone 280 PC, particle counter, U.S.A., and Olympus BH.2 RFCA microscope, Netherlands. These values were found to be:

- 9-10 µm (min. 0.8 µm, max. 31 µm) for oil A/water,
- 10-12 µm (min. 0.9 µm, max. 33 µm) for oil A4/water,
- 9-10 µm (min. 0.9 µm, max. 28 µm) for oil P1/water.

In order to measure the effluent oil concentration, a composite sample consisting of three individual samples that were taken after 45 min at 5-min intervals was analyzed for each experiment. Oil concentration was measured using a ThermoNicolet 5700 FTIR spectrometer, U.S.A.

3. RESULTS AND DISCUSSION

3. 1. Lipophilic/hydrophilic ratio for polymer fibers (L/H ratio)

Detailed literature search showed that investigations of liquid penetration kinetics for pure polymers fibres are lacking. Considering that polymer fibres have been dominantly used for separation of oil droplets from water, the present study aimed at providing the data that would be useful in practice.

In the methodology of Kulkarni [31] the L/H ratio was determined using two standard liquids that are not present in real systems when separation is performed. These standard liquids were deionized water (polar dispersed phase) and Viscor-1487 oil, used as a calibration fluid for diesel fuel (continuous phase). Therefore, this selection of liquids is not useful for emulsions when water is the continuous phase. Determination of liquid penetration kinetics for polymer fibres using only one standard oil does not have practical significance. The polymer fibre bed must separate oil from oily water having a wide range of different properties that are not existent in diesel dehydration investigated by Kulkarni. Previous investigations have shown that the separation efficiency is highly influenced by the nature of dispersed oil [1,2,6,7]. For these reasons, to maintain real conditions, in the present study mineral oils are introduced in the experiments.

The overall wetting kinetics for each polymer fibre was obtained by plotting the square of penetrating liquid mass (w^2) against time. Considering the high number of experiments, representative diagrams are shown in the next several figures. All wetting kinetic curves of fibre beds obtained with water are presented in Figure 2. It was observed that the water uptake rate was drastically different for different polymers. The highest rate of water uptake was for PP fibres identified as a very steep rise at the beginning of the experiment, whereas the lowest rate was detected for fibres BA1 and PU.

Numerical data for the slopes of all experimental lines obtained in the first 15 second period for deionized water are given in Table 2. Determination coefficients are satisfying. It could be seen that slops of experimental lines are in a wide range of numerical values. The slope value for PP fibres is very high, 48 g^2 s^{-1}, while in contrast to this, the slop value for PU fibres is low 0.056 g^2 s^{-1}.

The wetting kinetic curves of oil A for all investigated fibres are shown in Figure 3. It can be observed that the uptake rate of oil A was the highest for PE and PP fibres.

Table 2. *Initial slops of experimental wetting kinetic curves for deionised water, S_{H20}, and appropriate determination coefficients*

Fibre medium	Deionised water	
	S_{H_2O} / g^2s^{-1}	R^2
PU	0.056±0.003	0.974
BA1	0.102±0.001	0.970
PE	3.423±0.170	0.961
PP	48.069±1.121	0.974

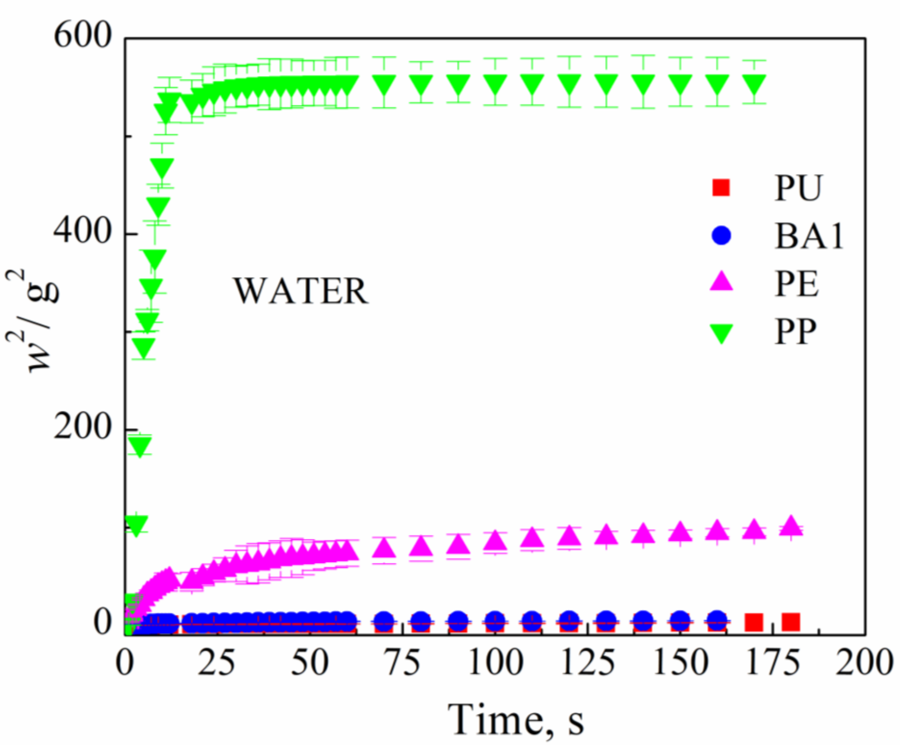

Figure 2. Wetting kinetic curves of PU, BA1, PE and PP fibers using deionized water as the test liquid

Comparison of wetting kinetic curves of PU polymer fibers with all investigated mineral oils is presented in Figure 4 revealing significant differences among the oils. The uptake rates of oils A4 and P1 were significantly lower than the rates of the other two oils.

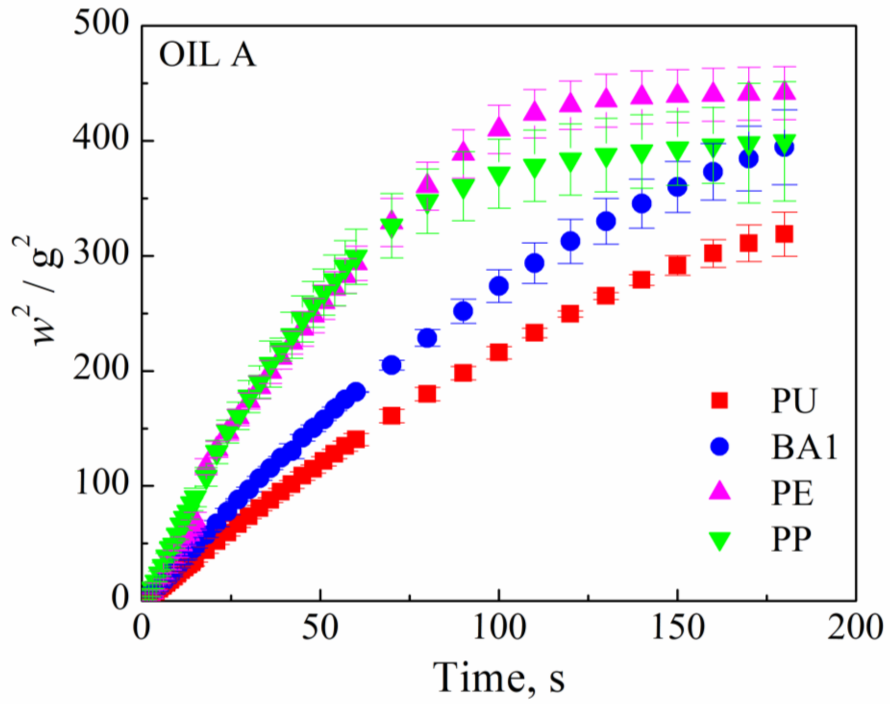

Figure 3. *Wetting kinetic curves of oil A and all investigated polymer fibers*

Numerical values of slopes for all investigated oils and test polymer fibres are presented in Table 3.

Table 3. Initial slops of experimental wetting kinetic curves (S) for mineral oils for all investigated polymers and appropriate determination coefficients

Fibre media	A		A1		A4		P1		BU	
	S_A / g^2 s^{-1}	R^2	S_{A1} / g^2 s^{-1}	R^2	S_{A4} / g^2 s^{-1}	R^2	S_{P1} / g^2 s^{-1}	R^2	S_{BU} / g^2 s^{-1}	R^2
PU	2.562±0.113	0.999	11.045±0.496	0.994	0.603±0.051	0.988	6.424±0.566	0.996	4.690±0.353	0.999
BA1	3.311±0.142	0.996	10.336±0.727	0.998	0.561±0.055	0.998	15.411±0.573	0.997	10.907±0.887	0.997
PE	5.023±0.495	0.998	15.004±0.675	0.988	0.877±0.042	0.997	17.789±0.286	0.970	14.787±0.719	0.997
PP	7.429±0.245	0.998	18.886±0.572	0.977	1.621±0.108	0.997	19.976±1.445	0.979	16.664±0.624	0.985

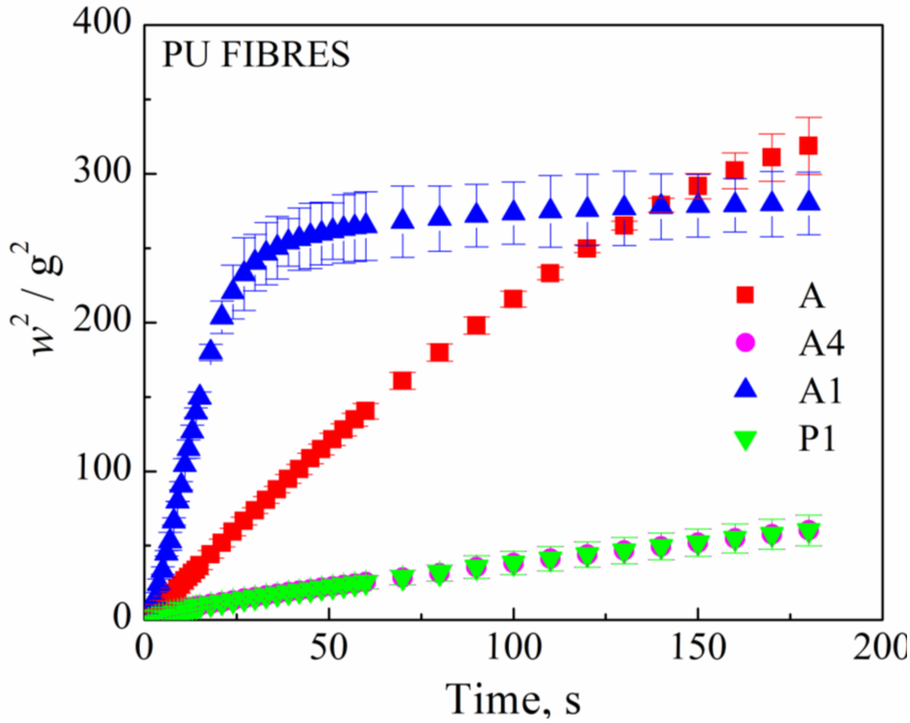

Figure 4. Wetting kinetic curves of PU fibers with A, A4, A1 and P1 mineral oils.

Based on these experimental data, the L/H ratios are calculated and presented in Table 4.

Table 4. L/H ratio values for all fiber materials and test oils

Fiber Material	L/H ratio				
	A	**A1**	**A4**	**P1**	**BU**
PU	17844	15844	39196	9730	2084
BA1	12661	8140	20020	12815	2660
PE	572	352	933	441	107
PP	60	32	123	35	9

The results showed that the obtained values for the L/H ratio were in a very wide interval of numerical values (from 9 to 39196). The broadest range of the L/H ratios was recorded for oil A4 (from 123 to 39196) whereas the narrowest interval was detected for BU oil (from 9 to 2660).

Furthermore, it is important to point out that the lowest values of the L/H ratio were obtained for the BU oil for all investigated fibers. Polymer fiber PU reached the broadest interval of L/H ratio values (from 2084 to 39196), while the narrowest interval (from 9 to 60) was obtained for the polymer PP.

These wide divergences of L/H ratio values are difficult to operate with and may practically lead to errors in judgment of the overall process. For example, according to the obtained values for oil A4, it could be concluded that this oil extremely wetted PU fibres (39196) and did not wet PP fibres (123). However, these conclusions are not in agreement with our experimental data for the bed coalescence separation efficiency of the mentioned polymers fibres [7].

Considering that the obtained L/H ratios were not applicable for the investigated polymers, there was a need to search for an alternative relation that would be adequate for polymer fibers and mineral oils of different polarities.

3.2. Introduction of the novel property lipophilic/lyophobic ratio (LLR)

Because the L/H ratios were not in agreement with experimental data for the bed coalescence separation efficiency of the investigated polymers, we have introduced a new property. The investigated mineral oils A, A1, A4 and P1, were polar, and in the same time, perfectly wetted the chosen polymers. These oils were selected as representatives for polar fluids. The second reference liquid should be non-polar. Considering that medical, white oil, BU, is a non-polar oil (neutralization number is 0 mg KOH L^{-1}), it was selected as a new referent liquid for our investigation. The medical oil did not wet polymer fibres. Therefore, all test liquids were mineral oils, but four of them were polar and lipophilic, (index o), and one was non-polar and lyophobic (index wo). In this way, the lipophilic/lyophobic ratio (LLR) was established that represented the ratio of liquid penetration kinetics of polar oils (A, A4, A1, P1) and non-polar oil (BU), equation 3.

$$\mathrm{LLR} = \frac{S_0 \eta_0 C_{\mathrm{wo}} \rho_{\mathrm{wo}}^2 \gamma_{\mathrm{wo}}}{S_{\mathrm{wo}} \eta_{\mathrm{wo}} C_0 \rho_0^2 \gamma_0} \tag{3}$$

The obtained values of the LLR are presented in Table 5 indicating the wettability performance of all studied polymer fibres. The LLR-values were in the range from 3.28 to 18.81 for all polymer fibres. In this case, the LLR values for P1 oil showed a very narrow range (from 4.09 to 4.82) obviously different to the values of L/H ratio. The broadest range of LLR was observed for oil A4 (from 7.53 to 18.18). It should be emphasized that by using the obtained LLR property, the problem of high values and extremely broad ranges of L/H ratio was evidently solved.

Table 5 The LLR values for all polymer fibers and test oils

Fiber material	A	A1	A4	P1
PU	8.56	7.60	18.81	4.67
BA1	4.76	3.06	7.53	4.82
PE	5.33	3.28	8.68	4.10
PP	6.99	3.66	14.23	4.09

The question arises if there was any relation between the LLR and properties of the investigated mineral oils. From Figure 5, it can be clearly seen that the LLR increases with the increase of the neutralization number of the investigated oils above the value of about 1 mg KOH L^{-1} for all polymer fibers. This dependence indicated that the introduced LLR parameter is extremely sensitive and perfectly reflects the affinity of polymers to the oils.

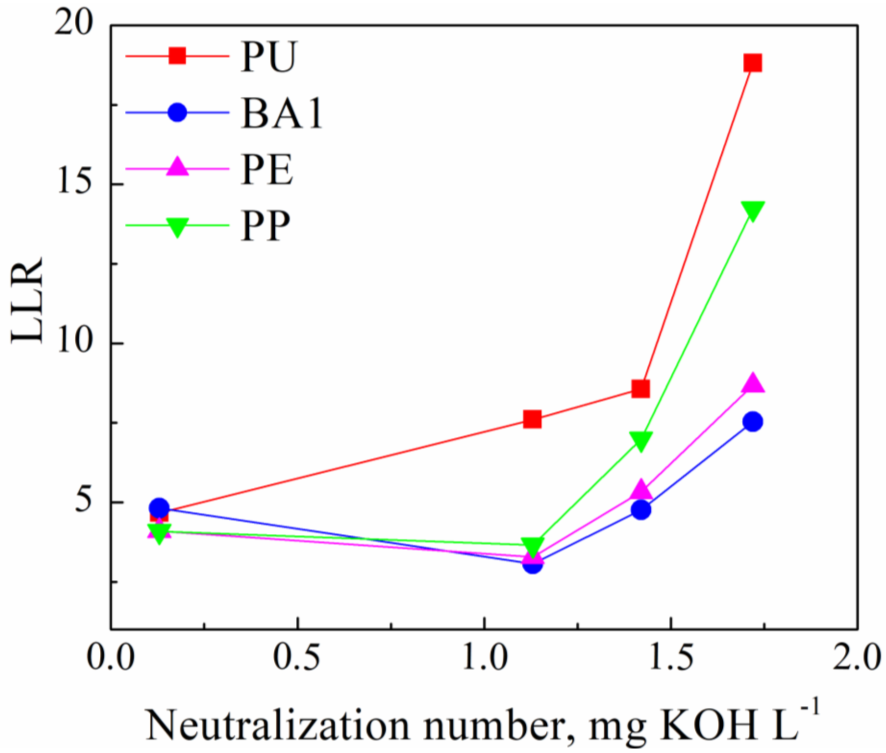

Figure 5. Dependence of the LLR on the neutralization number for all investigated oils and polymer fibers

The following question must be raised to clarify the role of the obtained LLR: If the correlation between the oil polarity and LLR existed, did this indicate that the most efficient fiber was PU in the separation of mineral oils, particularly those with the highest polarity? To give an answer to the raised question, separation experiments of oil droplets using a bed coalescer were conducted.

Oil viscosity had a significant role in the separation efficiency during the coalescence of oil droplets in fiber beds. In Figure 6, the influence of oil viscosity on the LLR is presented, showing clearly that the LLR increases with the viscosity increase for all investigated polymer fibers.

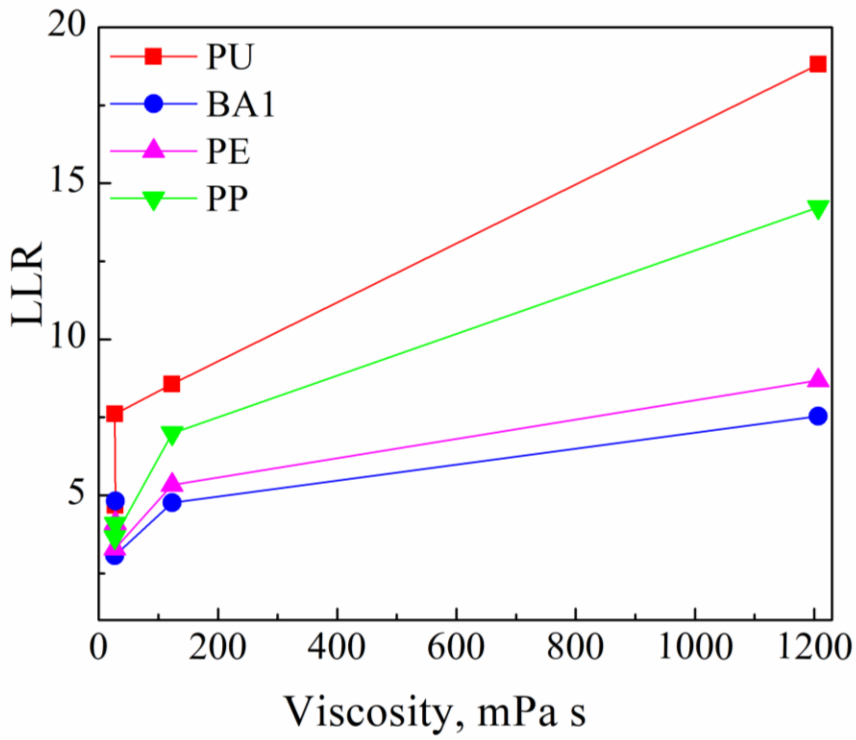

Figure 6. Dependence of the LLR on the oil viscosity for all investigated oils and polymer fibers

3.3. Correlation between the LLR and the bed coalescence efficiency

In our previous investigations [1,2,6,7] the critical velocity was adopted as a measure of coalescence efficiency. The critical velocity, v_k, was described as the maximum fluid velocity at which the effluent quality was still satisfying. The critical velocity was defined as the fluid velocity when the effluent oil concentration reached 15 mg L^{-1}. From the practical point of view, the increase of critical velocity reduced the size of equipment, which is important especially for coalescers that are located at platforms for crude oil production and on ships. Critical velocity was determined using experimental results from the dependence of the effluent oil concentration on fluid velocity. Oil separation experiments that utilized bed coalescers were introduced in a wide range of fluid velocities to reach the exponential increase of oil effluent concentrations. In Figures 7 and 8, results of the dependence between the effluent oil concentration and fluid velocity are presented for all investigated oils (A, A1, A4, P1) and fiber bed materials (PE and BA1) over the bed permeability of $K_{03} = 1.128\ 10^{-9}\ m^2$.

In this way, values of the critical velocity were obtained and used to analyze the correlation with LLR. Considering that the investigation included simultaneous change of fiber material and dispersed oil properties, 3D diagrams and contour diagrams can be used to clarify the interdependences of the obtained results. The dependence of the critical velocity on the neutralization number and the LLR data is shown in Figure 9, whereas the contour plot is presented in Figure 10. Based on these two diagrams, it can be observed that there was a notable correlation between the critical velocity as a dependent variable and the LLR as an independent variable.

When the LLR increased, the critical velocity also increased, generating a wide range of values between 20 and 55 m h^{-1} caused by the neutralization number of the investigated mineral oils. The most favorable conditions for the oil separation were high values of LLR, particularly higher than 6 for all oil polarities presented by the neutralization number. In the ranges of LLR and neutralization number from 8 to 14 and 0.4 to 1.2 mg KOH L^{-1}, respectively, the critical velocity maximum was 55 m h^{-1}.

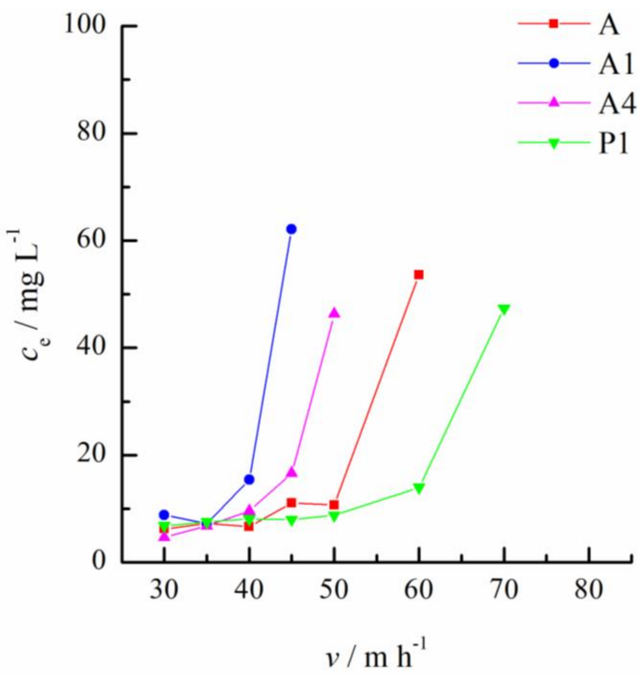

Figure 7. Dependence of the effluent oil concentration on fluid velocity for all investigated oils and BA1 polymer fiber

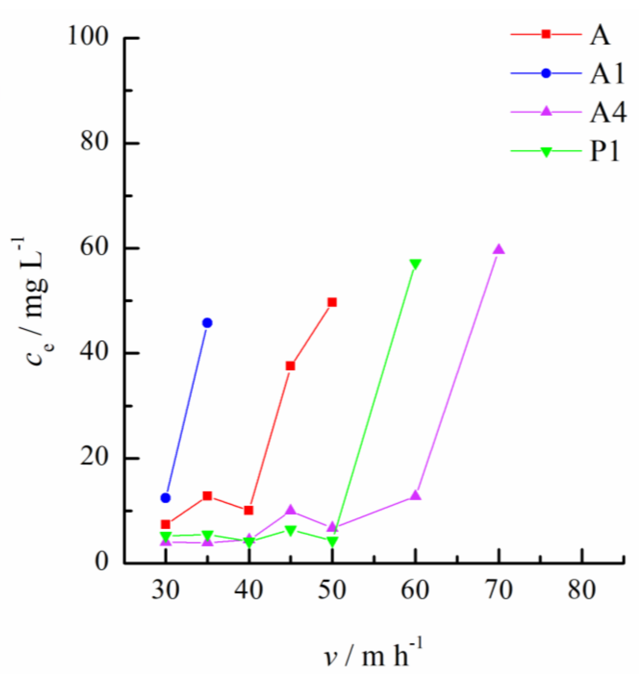

Figure 8. Dependence of the effluent oil concentration on fluid velocity for all investigated oils and PE polymer fiber

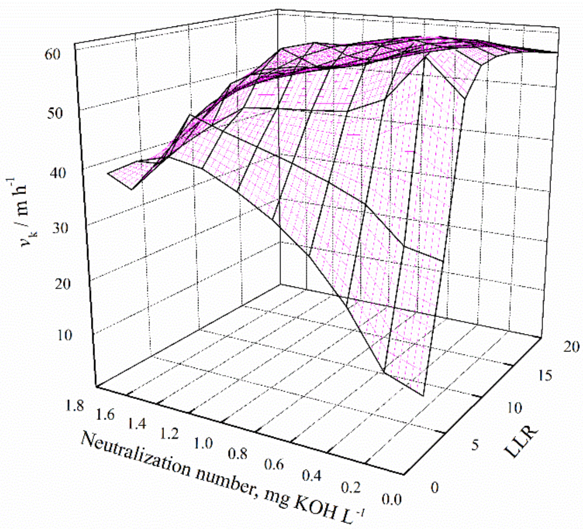

Figure 9. 3D dependence of the critical velocity on the neutralization number and LLR

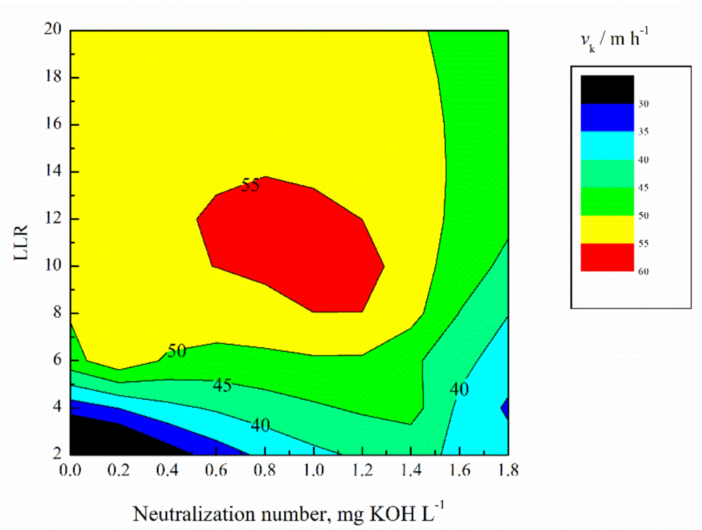

Figure 10. Contour diagram of the critical velocity dependence on the neutralization number and LLR

From the obtained results, it can be concluded that the selected polymer fibres efficiently separated all the investigated mineral oils generating critical velocities of 40 m h^{-1} and above. In addition, it can be concluded that the critical velocity reached the maximum when the oil polarity was in a medium range and when the LLR values were above 6. The analysis of the data from Table 2 showed that the PU material had three LLR values higher than 6, the PP material had two, while the BA1 and PE material had only one, each.

As the viscosity of dispersed oils is another important property that determines the efficiency of oil droplet separation, 3D and contour plots are presented in Figures 11 and 12, showing the dependence of the critical velocity on the LLR and oil viscosity. With the increase in LLR, the critical velocity also increased over the whole range of oil viscosities. The critical velocity that exceeded 50 m h^{-1} was achieved when the LLR was higher than 6 and at low oil viscosities. It should be added that the bed geometry was constant in all experiments keeping the bed permeability constant so that the influence of the bed geometry on the experimental results was eliminated.

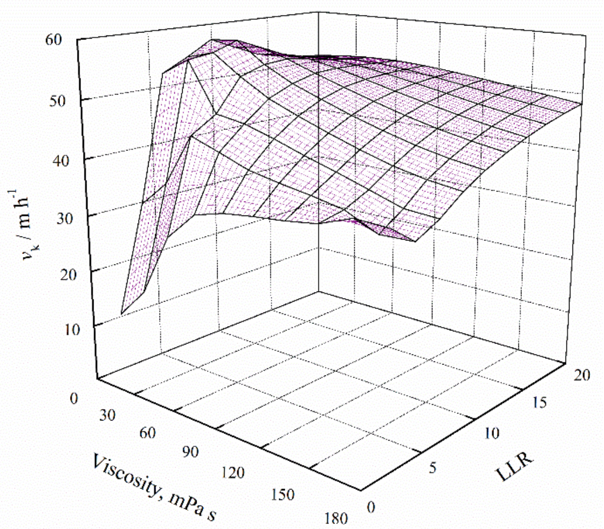

Figure 11. 3D dependence of the critical velocity on the oil viscosity and LLR

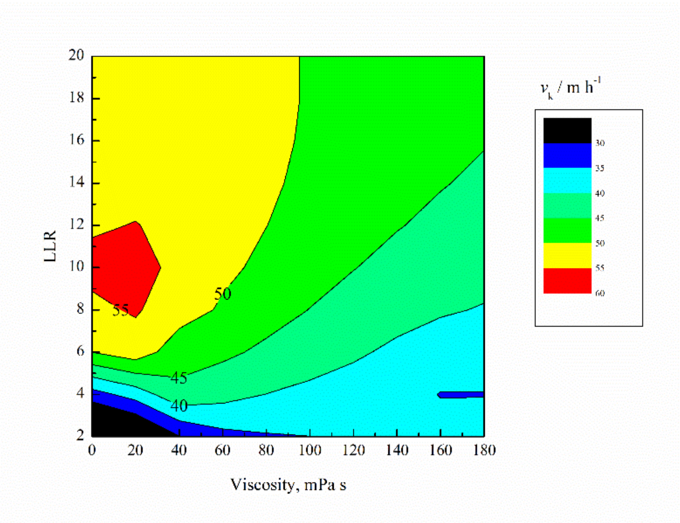

Figure 12. Contour diagram of the critical velocity dependence on the oil viscosity and LLR

4. CONCLUSION

The presented results confirmed that the novel property, lipophilic/lyophobic ratio (LLR), developed and investigated in this study, is an adequate wetting property of fibers, allowing selection of the appropriate polymer fibers for separation of mineral oils of different polarities, and for predicting successful and effective separation. This indicates that a simple, fast and inexpensive experiment can replace pilot plant experiments used with the aim to select a polymer for oil separation from wastewater.

NOMENCLATURE

S - slope of the experimental wetting kinetic curve
w - the mass of the penetrating liquid, g
η - viscosity of the penetrating liquid, mPa s
γ - surface tension of the penetrating liquid, mN m^{-1}
ρ - liquid density, kg m^{-3}
C - a lumped constant defined when one of the liquids completely wets the surface
V_{TW} = total water volume, m^3
V_{FW} = free water volume, m^3

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SAŽETAK

Predviđanje efikasnosti separacije ulja iz vode pomoću sloja vlakana korišćenjem nove veličine filtarskog mediuma

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(Naučni rad)

Koalescentni filtri su kompaktni, lako se instaliraju, automatizuju i održavaju, postižu visoku efikasnost separacije i sve više se primenjuju u industriji iako su za njihovo projektovanje potrebna poluindustrijska istraživanja. U ovom radu predstavljena je nova veličina (LLR) koja opisuje kvašljivost vlakana polimera polarnim mineralnim uljima. Ta veličina može da posluži za selekciju filtarskog materijala za separaciju konkretnog ulja prisutnog u otpadnoj vodi. Medicinsko belo ulje je odabrano za referentnu nepolarnu tečnost pošto ono ne kvasi vlakna polimera. Veličina LLR dostiže vrednost od 3,28 do 18,81. Veličina LLR raste porastom neutralizacionog broja koje je merilo polarnosti mineralnih ulja. Takođe raste porastom viskoznosti ulja. Veličina LLR je u odličnoj korelaciji sa rezultatima efikasnosti separacije kapi ulja iz otpadne vode korišćenjem koalescentnih filtera. Jednostavan, brz i jeftin test može da zameni skupe poluindustrijske eksperimente koji treba da odaberu adekvatan polimer za separaciju konretnog mineralnog ulja određenih osobina.

Ključne reči: zauljena voda, sloj vlakana, efikasnost koalescencije, kvašljivost polimernih vlakana, separacija kapi