TREATMENT OF OILY WASTEWATER
APPLYING WASTE FIBER MATERIAL AS FILTER MEDIA

Dunja SOKOLOVIĆ,
University of Novi Sad, Faculty of Technical Sciences, Serbia,

Arpad KIRALJ,
University of Novi Sad, Faculty of Technology, Serbia,

Srđan SOKOLOVIĆ,
NIS a.d. Novi Sad, Serbia
Oily wastewater is generated in many industrial processes, such as:

- petroleum refining
- petrochemical & chemical industry
- food processing
- pharmaceutical industry
- etc.
How to treat the oily wastewater?

**oily water treatment:**

- settlers
- centrifuges
- absorbers
- membranes
- deep bed filters
- bed coalescers
- others
When the bed coalescer is the best chose?

- When oil droplets are smaller than 80 µm
- Why the coalescers are the best option?
  - low energy consumption
  - small unit size
  - high capacity
Bed coalescers
Separation of four oils different properties using bed of waste PET fibres over different bed geometry was investigated.
# Properties of Oils Used for Preparation of Unstable Model Emulsions

<table>
<thead>
<tr>
<th>Properties</th>
<th>A</th>
<th>A4</th>
<th>A1</th>
<th>P1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density at 15 °C kg/m³</td>
<td>916.7</td>
<td>923.3</td>
<td>907.3</td>
<td>883.3</td>
</tr>
<tr>
<td>Density at 20 °C kg/m³</td>
<td>915.5</td>
<td>918.9</td>
<td>905.9</td>
<td>879</td>
</tr>
<tr>
<td>Viscosity at 40°C mPa s</td>
<td>43.35</td>
<td>168.904</td>
<td>9.183</td>
<td>10.316</td>
</tr>
<tr>
<td>Neutralisation number mg KOH/l</td>
<td>1.42</td>
<td>1.71</td>
<td>1.13</td>
<td>0.13</td>
</tr>
<tr>
<td>Pour point °C</td>
<td>-42</td>
<td>-3</td>
<td>-56</td>
<td>3</td>
</tr>
<tr>
<td>Surface tension mN/m</td>
<td>26.56</td>
<td>27.72</td>
<td>28.91</td>
<td>30.16</td>
</tr>
<tr>
<td>Emulsivity %</td>
<td>99.92</td>
<td>70</td>
<td>56.25</td>
<td>54.17</td>
</tr>
<tr>
<td>Dielectric constant</td>
<td>0.1612</td>
<td>0.1905</td>
<td>0.1334</td>
<td>0.0645</td>
</tr>
<tr>
<td>Mean molecular weight kg/kmol</td>
<td>410</td>
<td>520</td>
<td>150</td>
<td>300</td>
</tr>
</tbody>
</table>
WASTE POLYMER FIBROUS USED AS BED MATERIAL

The PET fibrous is waste material of thermal filling for winter jackets

*Compressible fibers*

**wide range of bed porosity and permeability could be obtained**
EXPERIMENTAL CONDITIONS

steady-state regime

- Porosity 0.85-0.97
- Permeability 0.18-0.54 mm²
- Fluid velocity varied from 19 to 80 m/h
- Inlet oil concentration was 500 mg/l
- The oil concentration in the effluent was determined by FTIR spectrometry
The critical velocity ($v_k$) is the velocity at which the effluent concentration of the dispersed oil is 15 mg/L.
RESULTS

The results are analyzed by contour diagrams:

- Fluid velocity
- Oil concentration in effluent
- Permeability of the bed
$v_k = 37 - 56 \text{ m/h}$

$C_i \text{ mg L}^{-1}$
\[ v_k = 45-55 \text{ m/h} \]

\[ v_k = 30-35 \text{ m/h} \]
CONCLUSIONS:

• The waste PET fibers are effective medium for treatment of oily wastewater

• The highest critical velocity is obtained for separation of oil P1 (55 m/h), while the lowest is for oil A1 (37 m/h), other two oils obtain also high critical velocities, oil A (50 m/h) and oil A4 (52 m/h)

• Tested PET material shows sensitivity to the nature of oil dispersed in water therefore the design of the coalescer with waste PET bed material should be based on experimental data
THANK YOU FOR YOUR ATTENTION !!!!

Dunja Sokolović, Associate Professor
Department for Energy and Process Engineering
Faculty of Technical Sciences,
University of Novi Sad,
dunjaso@uns.ac.rs