VSB TECHNICAL UNIVERSITY OF OSTRAVA | CENTRE FOR ENERGY AND ENVIRONMENTAL TECHNOLOGIES | NANOTECHNOLOGY CENTRE

U.PORTO

Evaluation of Electrospinning-Based Photocatalytic Membrane Preparation Methods for Phenol Degradation Under Visible Light

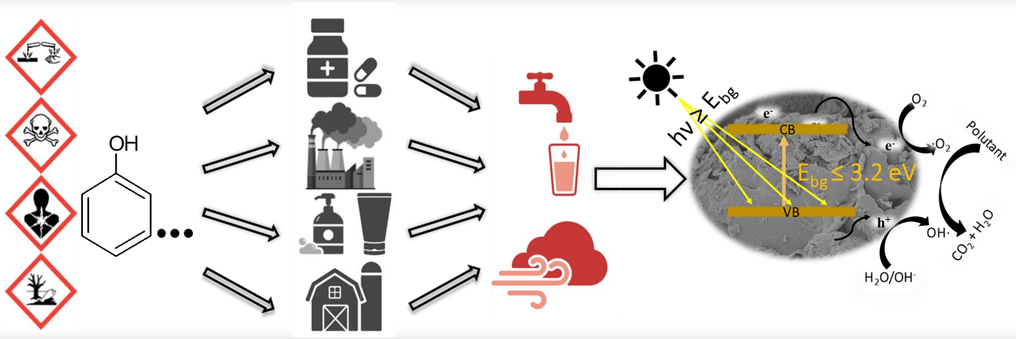
Z. Vilamová[1]*, M.J. Sampaio[2,3]*, L. Svoboda[1], J. Bednář[1], Z. Šimonová[4], R. Dvorský[4], C.G. Silva[2,3], J. L. Faria[2,3]

[1] *CNT, CEET, VSB – Technical University of Ostrava, Czech Republic*
[2] *LSRE-LCM, Faculty of Engineering, University of Porto, Portugal*
[3] *ALiCE , Faculty of Engineering, University of Porto, Portugal*
[4] *CPIT, FMT, VSB – Technical University of Ostrava, Czech Republic*
***zuzana.vilamova@vsb.cz, *mjsampaio@fe.up.pt**

MOTIVATION

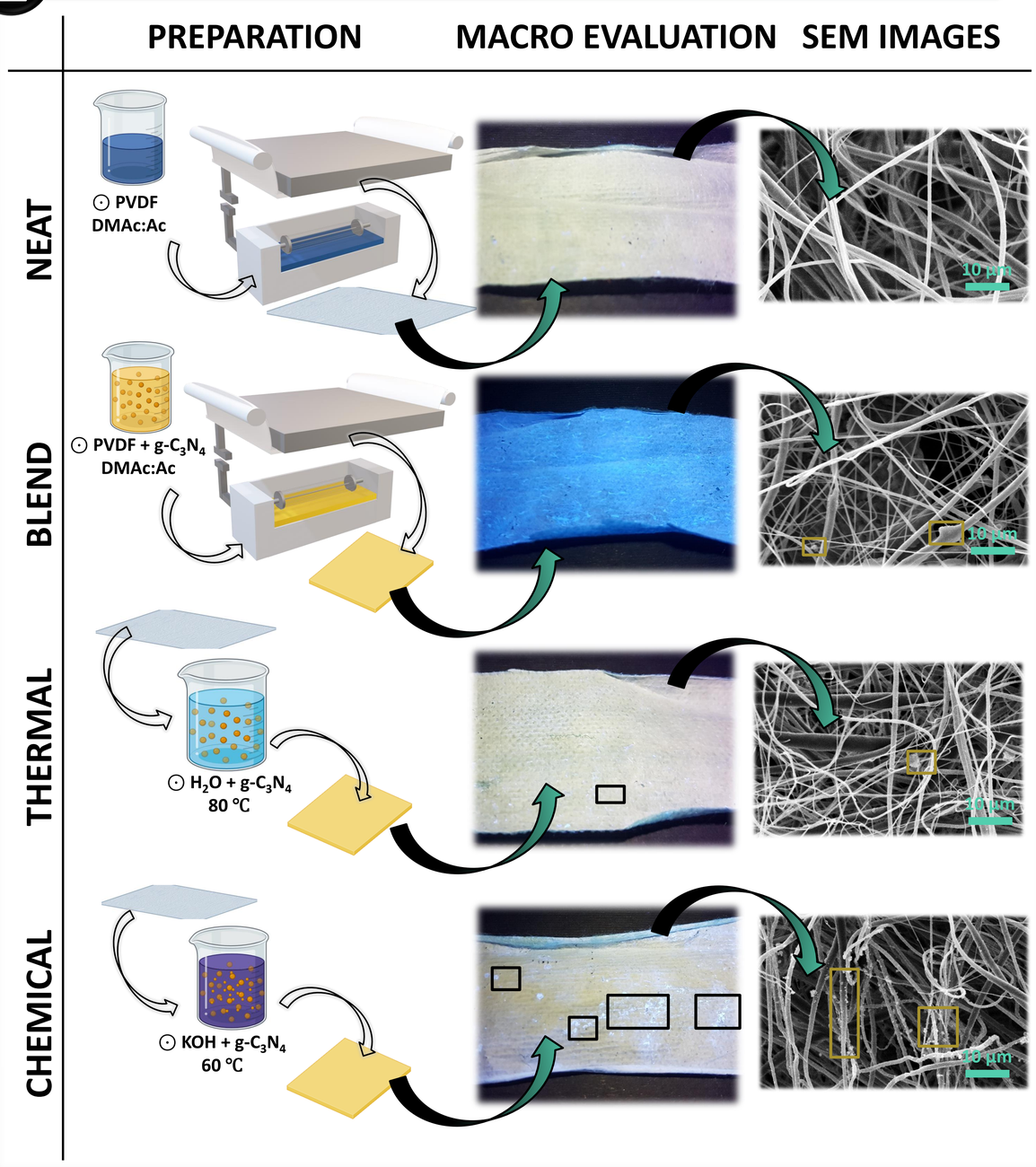
In recent times, fibrous membranes have developed a role in the **filtration of pollutants** from air or water. Unfortunately, if the filter membrane is used for several hours or days, it leads to a **gradually increasing concentration of pollutants** on the membrane surface. However, this contamination can be effectively **eliminated** by the presence of **photocatalytic submicroparticles** as a part of fibrous membranes.

We prepared a set of polyvinyl difluoride (PVDF) **fibrous photocatalytic membranes** and compared their photocatalytic activities by **phenol degradation in a batch reactor**. Our results indicate the reusable properties up to 3 cycles.

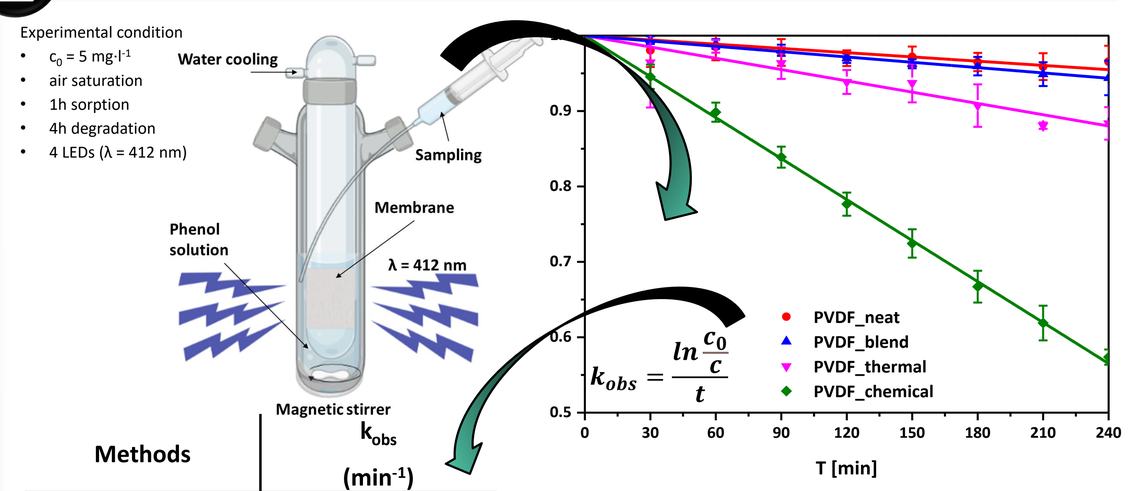


EXPERMENTS AND RESULTS

1 Membrane preparation and characterisation



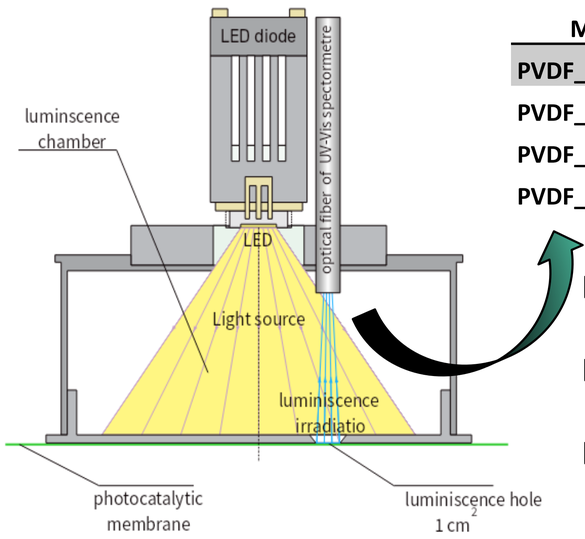
2 Photocatalytic experiments



Methods	k_{obs} (min^{-1})
PVDF_neat	0.00019
PVDF_blend	0.00024
PVDF_thermal	0.00053
PVDF_chemical	**0.00223**

- ❑ **Repeatability** of preparation
- ❑ Membrane **reuse**
- ❑ The **highest photocatalytic** activity by chemical

3 Non-destructive evaluation



Methods	(mg·cm^{-2})
PVDF_neat	0
PVDF_blend	1.7089 ± 0.0404
PVDF_thermal	0.0058 ± 0.0017
PVDF_chemical	0.3321 ± 0.0736

- ❑ LED diode 365 nm caused luminiscence at 438 nm
- ❑ The **highest density area** for *blend*, but **encapsulated in** fiber
- ❑ *PVDF_chemical* led to particle attachment **on fibers**

CONCLUSION

In this work, PVDF membranes were successfully prepared and evaluated. Although, the most used so-called blend method is economical, it leads to **the particle encapsulation** in the polymer fiber which significantly **decreases the photocatalytic activity**, where k_{app} = 0.00024 min^{-1}, and performs similar as the reference pure PVDF membrane with k_{app} = 0.00019 min^{-1}. The **thermal method** is not a proper method either. It had a **lower density area of attached particles**. Due to the structure and chemical stability of PVDF, we successfully activated it by carbonate buffer and attached pre-prepared photocatalytic **g-C_3N_4 particles on its surface by covalent bond**. This led to a **high area density** of photocatalytic active regions and PVDF_chemical showed **the highest photocatalytic activity** with k_{app} = 0.0018 min^{-1}. The significant **difference of photocatalytic kinetic** for PVDF_chemical membrane compared to PVDF_blend **is interesting** although concentration measurement of the photocatalytic particles showed huge difference for PVDF_blend

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REFRESH PolyEnvi21 MATUR