VANILLIN ACRYLATE-BASED POLYMERS WITH ANTIBACTERIAL ACTIVITY

Aukse Navaruckiene[1], Justinas Jaras[1], Danguole Bridziuviene[2], Vita Raudoniene[2],

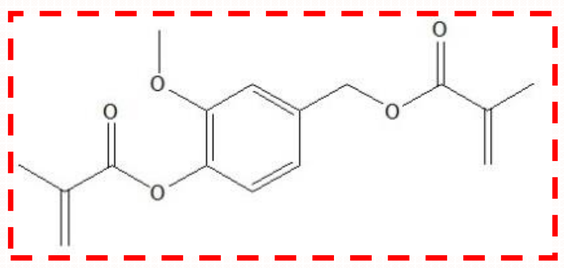
Jolita Ostrauskaitė[1]*

[1] Department of Polymer Chemistry and Technology, Kaunas University of Technology, Lithuania
[2] Biodegradation Research Laboratory, Nature Research Center, Lithuania
* *Contact address: jolita.ostrauskaite@ktu.lt*

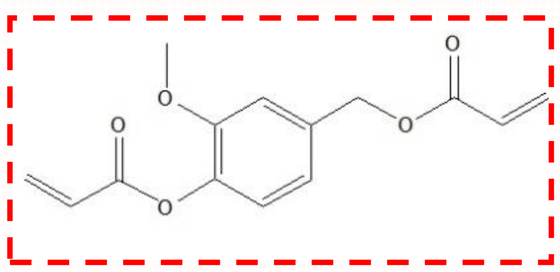
THE AIM

The aim of this work was to investigate the kinetics of free-radical and thiol-ene photopolymerization of vanillin diacrylate (VD) and vanillin dimethacrylate (VDM) using phenylbis(2,4,6-trimethylbenzoyl)phosphine oxide (BAPO) as photoinitiator, as well as rheological properties of the photocross-linked polymers by real-time photorheometry. The influence of the resin composition to UV/VIS curing time, rigidity and antibacterial properties of the resulting polymers was investigated.

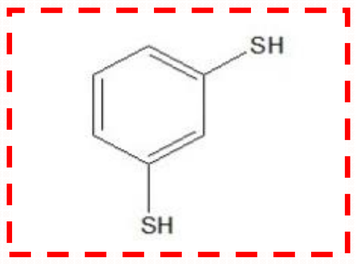
MATERIALS



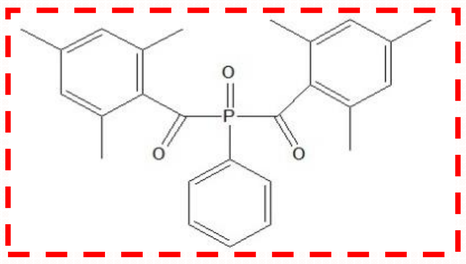
vanillin dimethacrylate (VDM)



vanillin diacrylate (VD)



1,3-benzenedithiol (BDT)

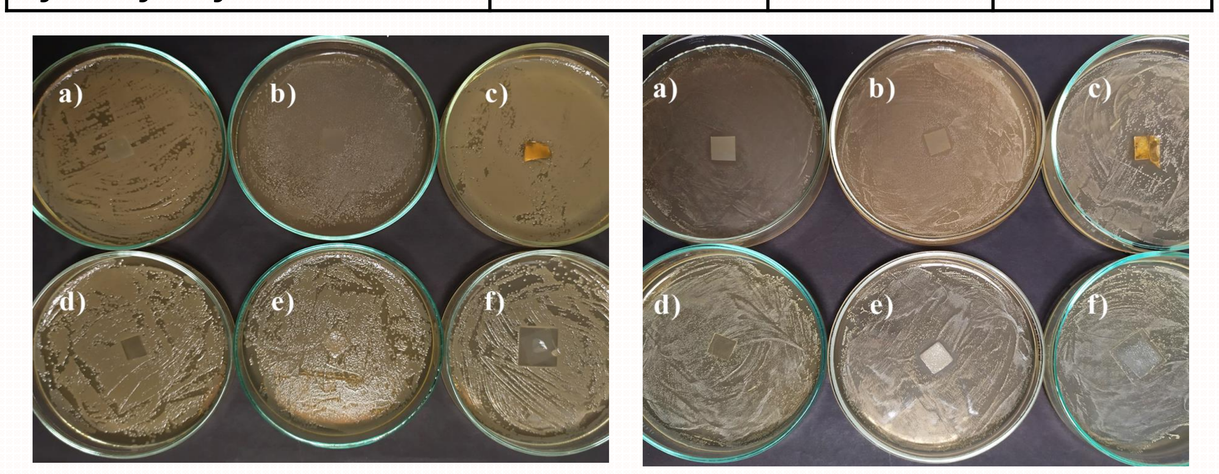


phenylbis(2,4,6-trimethylbenzoyl) phosphine oxide (BAPO)

Two vanillin derivatives were tested in photocurable systems with 1 or 0.5 mol of 1,3-benzenedithiol or without it, using 3 mol.% of bis(2,4,6-trimethylbenzoyl)phosphine oxide as photoinitiator.

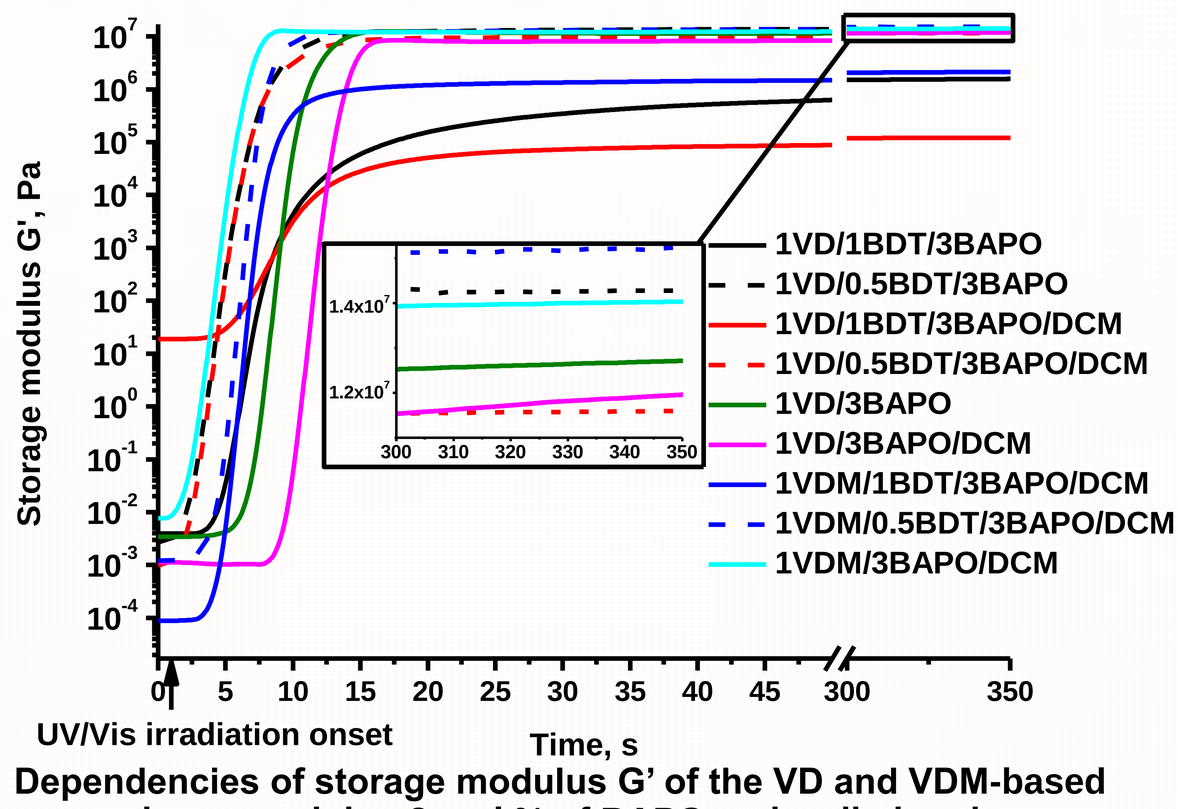
ANTIBACTERIAL ACTIVITY OF THE POLYMER FILMS

Polymer film	Growth Inhibition Zone, mm	Log Reduction after 24 h	Percent Reduction after 24 h
	Escherichia coli		
1VD/1BDT/3BAPO	0	0	100
1VD/1BDT/3BAPO/DCM	0	0	100
1VD/3BAPO	1.0±0.7	0	100
1VDM/1BDT/3BAPO/DCM	0	1.98	98.96
Chitosan	2.0±0.7	0	100
Hydroxyethyl starch	0	1.25	94.42
	Staphylococcus aureus		
1VD/1BDT/3BAPO	2.1±0.8	0	100
1VD/1BDT/3BAPO/DCM	2.0±0.0	0	100
1VD/3BAPO	2.1±0.8	0	100
1VDM/1BDT/3BAPO/DCM	0	0	100
Chitosan	2.5±0.5	0	100
Hydroxyethyl starch	0	2.85	99.86



Toxicity testing of polymer film specimens for *Escherichia coli* (left image) and *Staphylococus aureus* (right image) on MHA medium: a)1VD/1BDT/3BAPO, b)1VD/1BDT/3BAPO/DCM, c)1VD/3BAPO, d)1VDM/1BDT/3BAPO/DCM, e)chitosan, f)hydroxyethyl starch

RHEOLOGICAL CHARACTERISTICS OF RESINS



Dependencies of storage modulus G' of the VD and VDM-based resins, containing 3 mol.% of BAPO on irradiation time

CONCLUSIONS

- **The curing time was the shortest when vanillin dimethacrylate or vanillin diacrylate and ethylphenyl(2,4,6-trimethylbenzoyl) phosphinate were used in the compositions without 1,3-benzenedithiol and dichloromethane.**
- **The most rigid polymers were obtained when vanillin dimethacrylate or vanillin diacrylate and ethylphenyl(2,4,6-trimethylbenzoyl) phosphinate were used in the compositions with 0.5 mol.% of 1,3-benzenedithiol.**
- **Addition of dichloromethane into the resins resulted in less rigid polymers and longer UV curing time.**
- **Vanillin acrylate- and vanillin dimethacrylate-based polymers showed a significant antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* in direct contact and on medium.**

ACKNOWLEDGEMENT

This research was funded by the Research Council of Lithuania (project no. S-MIP-20-17), the EU ERDF, through the INTERREG BSR Programme, (ECOLABNET project #R077) and the European Social Fund under the measure no. 09.3.3-LMT-K712.