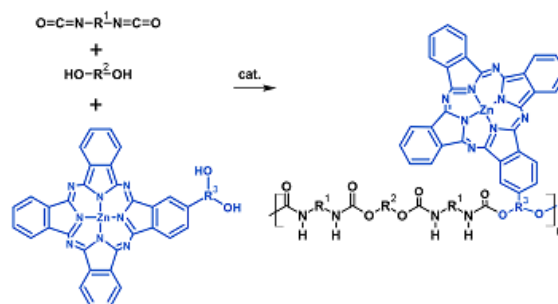


The global polyurethane (PU) market size was \$ 60.5 billion in 2017 and is projected to grow at \$ 79.2 billion to 2021. High demand for lightweight, durable and cheap materials saving the economic costs has driven the growth in recent years. Therefore, we had selected PU polymer due to its adaptability for various end-use industries such as furniture, automotive, construction, clothing and packaging. We had utilized reactive phthalocyanine (PC) dye to confer additive antimicrobial function to PU matrix. PC-diol is covalently attached to PU polymer (PC-PU), which avoids leakage of PC to the environment and dissipation of PC-PU antimicrobial function (Scheme 1).



Scheme 1. Preparation of polyurethane functionalized by reactive phthalocyanine dye.

Modified PC-PU was subjected to electrospinning process (Figure 1) that afforded well-oriented fibres with diameter less than 4 μm (Figure 2).¹ This not only augments the active surface of individual PC-PU fibres, but dense alignment can also retard the permeation of bacteria through multiple-layers of PC-PU mats.

Photosensitizing of PC-PU is a promising alternative method that ensures killing of pathogenic microorganisms, which does not induce the development of multi-resistant strains.² Portion of visible light absorbed by PC results in generation of reactive oxygen species (ROS), including singlet oxygen ($^1\text{O}_2$), free radicals, hydroxyl radical ($\text{HO}\cdot$) and superoxide anion (O_2^-) that cause irreversible cell death (Figure 3).³

Gram-positive, gram-negative bacterial strains and fungi were used to test the antimicrobial influence⁴ of PC-PU nanofiber mats. Subsequently, obtained results (Table 1) indicated that the prepared nanofibres have good bacteriostatic effect, particularly on gram-positive bacteria and fungi.

In conclusion, the potential use of PC-PU nanofiber mats as antimicrobial agents has been highlighted.

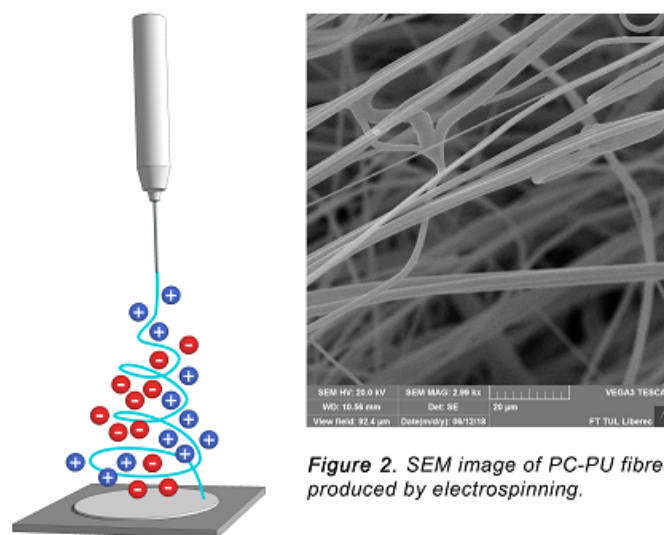


Figure 2. SEM image of PC-PU fibres produced by electrospinning.

Figure 1. Scheme of electrospinning process. Solution of PC-PU is injected into the high-voltage current that is able to electrospin fibres, which are collected on solid support.

	Content	Daylight/darkness (FACS)
G ⁺ bacteria	G ⁺	1.18
	G ⁺ + PU-PC	0.36
G ⁻ bacteria	G ⁻	0.09
	G ⁻ + PU-PC	0.03
fungi	fungi	2.09
	fungi + PU-PC	0.62

Table 1. Evaluation of bacterial and fungi population (measured by FACS method as the ratio between daylight and darkness counts) without/with PU-PC mats.

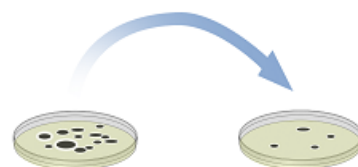


Figure 3. Scheme of ROS production by photosensitizing of PC-PU.