New generation
of antimicrobial, eco-friendly, multifunctional composite materials

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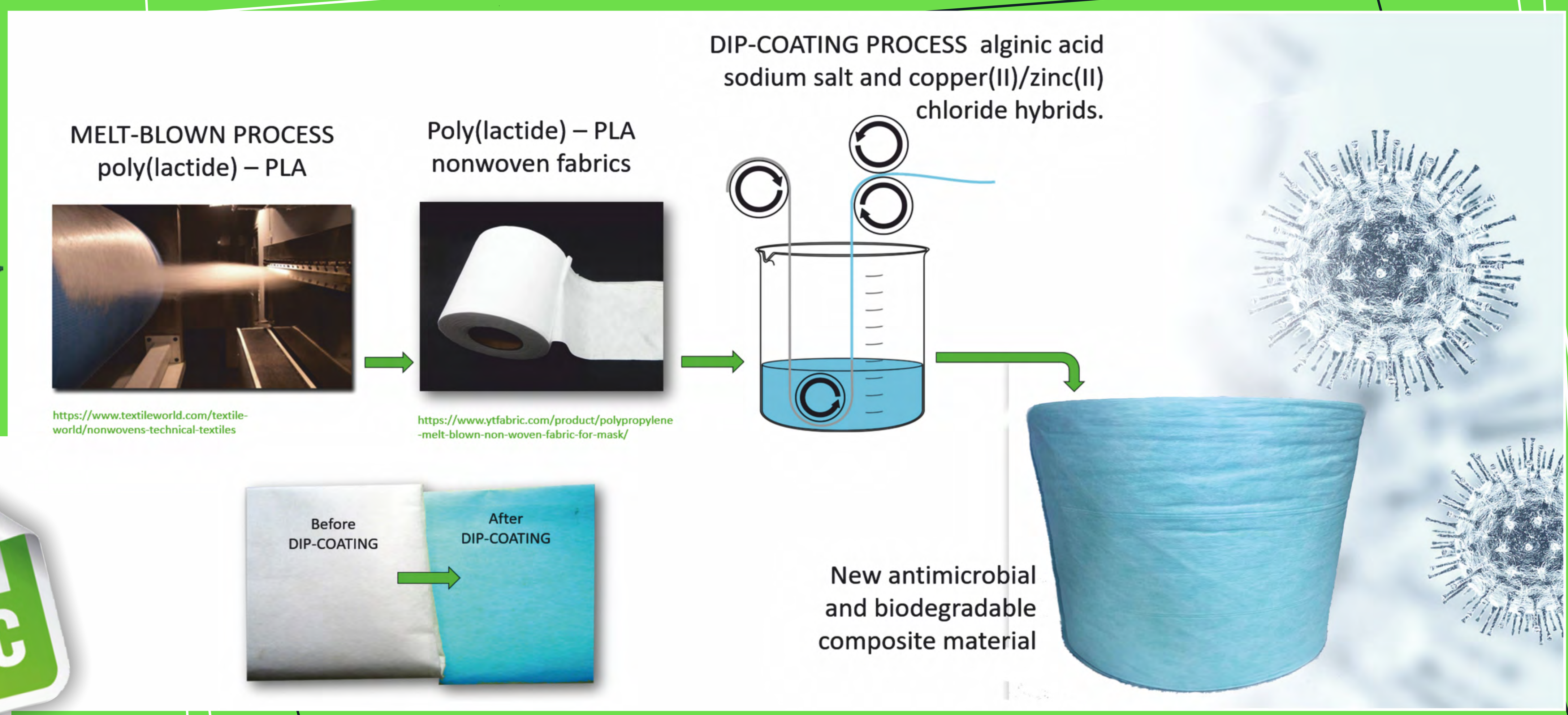
The concept refers to the new antimicrobial and biodegradable composite material consisting of: poly(lactide) – PLA nonwoven fabrics produced by melt-blown process, alginic acid sodium salt and copper(II)/zinc(II) chloride hybrids.



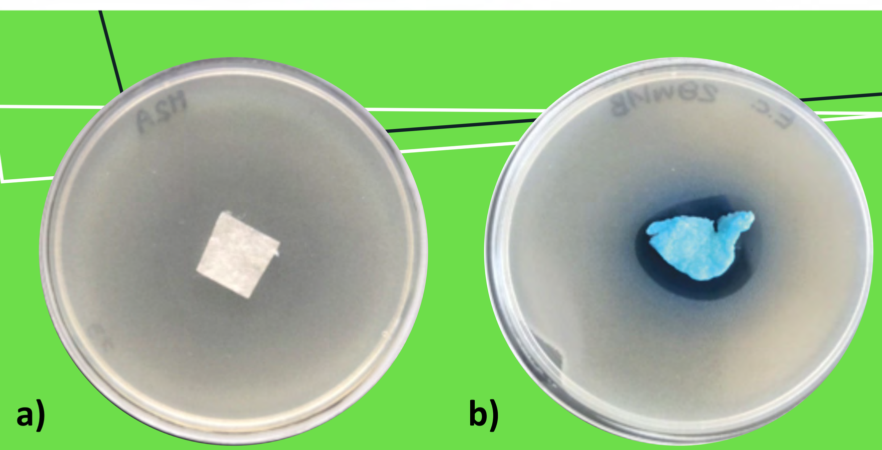


Figure 1. The polylactide/alginate/copper (PLA–ALG-Cu^{2+}) composites' antimicrobial activity tests. Inhibition zones of *Escherichia Coli* bacterial growth on Petri dishes, sample: **(a)** PLA and **(b)** PLAALG-Cu^{2+} ●

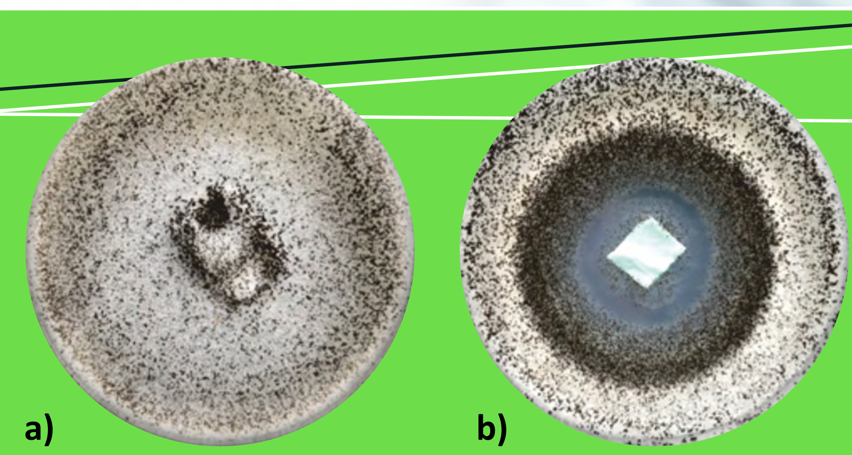


Figure 3. The PLA–ALG–Cu^{2+} composites antimicrobial activity tests against *Aspergillus niger* (ATCC 6275). Inhibition properties of fungal growth on Petri dishes: **(a)** PLA and **(b)** PLA–ALG-Cu^{2+} ●

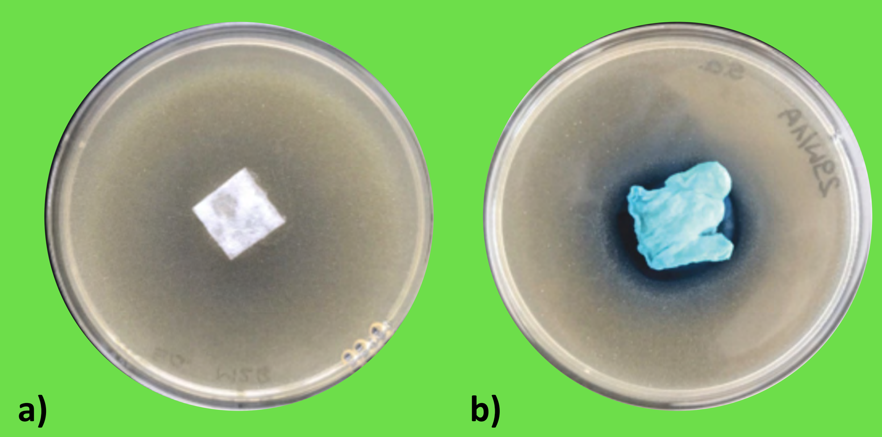


Figure 2. The polylactide/alginate/copper (PLA–ALG–Cu^{2+}) composites' antimicrobial activity tests. Inhibition zones of *Staphylococcus aureus* bacterial growth on Petri dishes, sample: **(a)** PLA and **(b)** PLA–ALG-Cu^{2+} ●

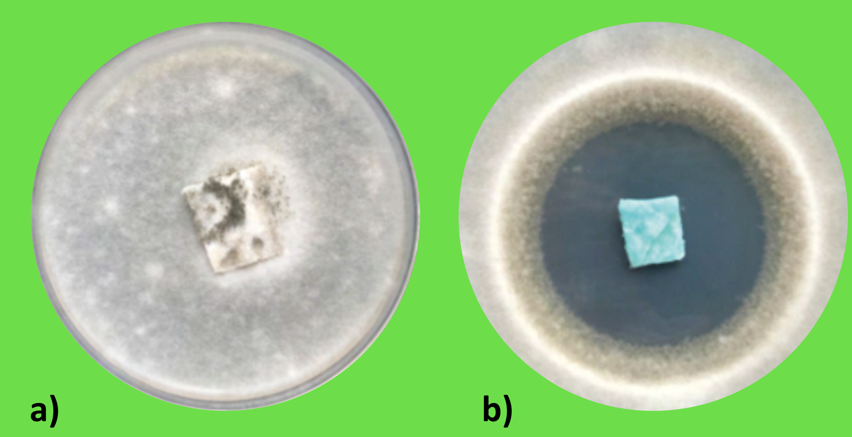


Figure 4. The PLA–ALG–Cu^{2+} composites' antimicrobial activity tests against *Chaetomium globosum*. Inhibition properties of fungal growth on Petri dishes: **(a)** PLA and **(b)** PLA–ALG-Cu^{2+} ●

● Kudzin M. H.; Boguń M.; Mrozińska Z.; Kaczmarek A., Physical Properties, Chemical Analysis, and Evaluation of Antimicrobial Response of New Polylactide/Alginate/Copper Composite Materials. Marine Drugs, 2020, 18(12), 660. DOI: 10.3390/md18120660.

The most important features of the new composite material are:

- biodegradable eco-friendly composite, consist of >98% natural ingredients, what is very important during intensive use of protective equipment - face masks;
- antimicrobial properties against broad spectrum of microorganisms (bacteria, fungi, viruses) (**Fig. 1-4**);
- non-toxic material;
- low costs and waste-free production;
- all required materials are commercially available and relatively cheap;
- improvement of technical parameters in comparison with raw PLA nonwovens, including tensile strength and barrier properties against UV radiation;
- easy to implement on an industrial scale.

The newly developed composite materials can be used in biomedical areas for the prevention of bacterial and viral infections, including COVID - 19 as a filtering layer in face masks. Currently, during the pandemic such composites can also be applied as microbiostatic materials in broad spectrum of industrial areas (e.g air filtration, packaging, interior furnishings, automotive).

The innovation of the invention is the use of fully biodegradable and environmentally friendly and human-friendly materials of natural origin - polylactide and sodium / copper alginate to produce composites intended for protective elements used in the prevention of bacterial and viral infections, including COVID-19 infections. These materials have antimicrobial properties. against a wide range of microorganisms (bacteria, fungi, viruses). Their production is low-cost and does not generate waste.

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