

Polylactide : Antimicrobial modifications

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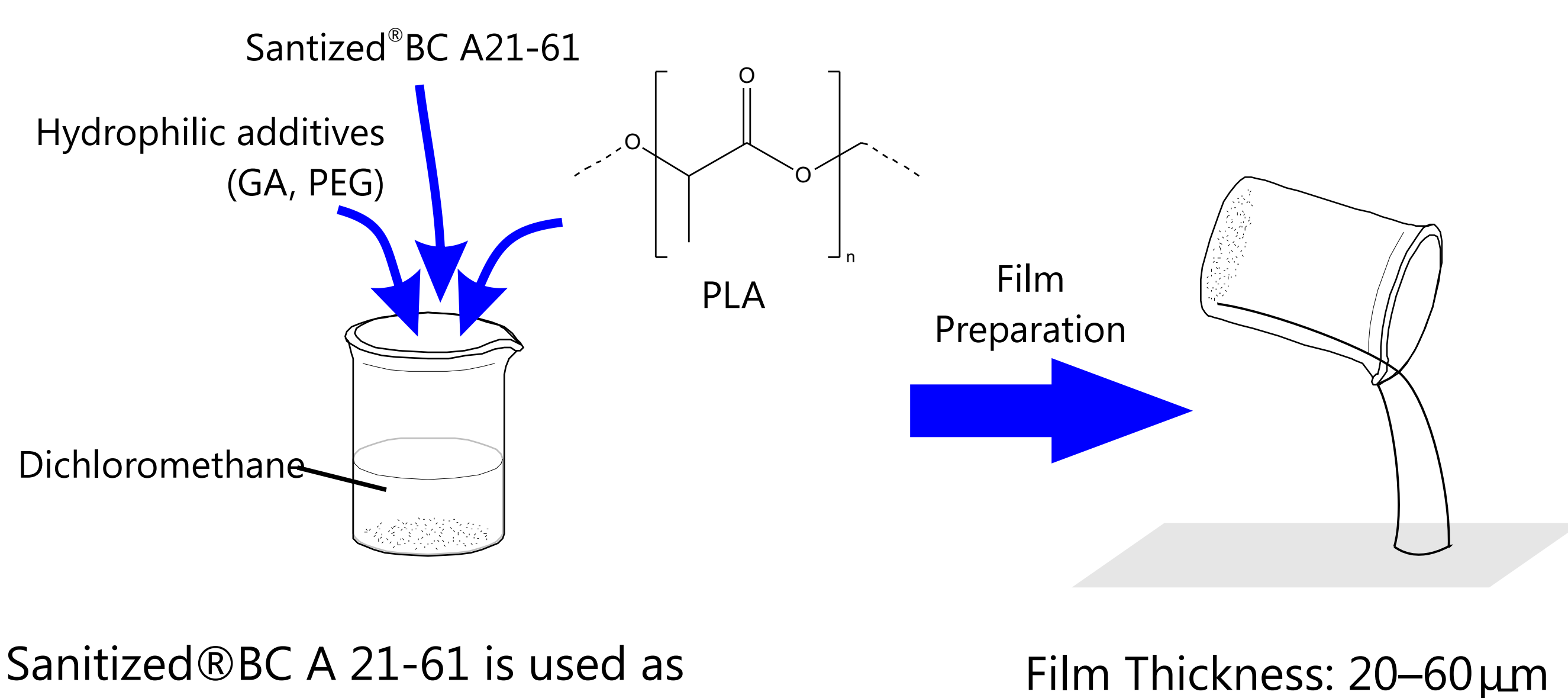
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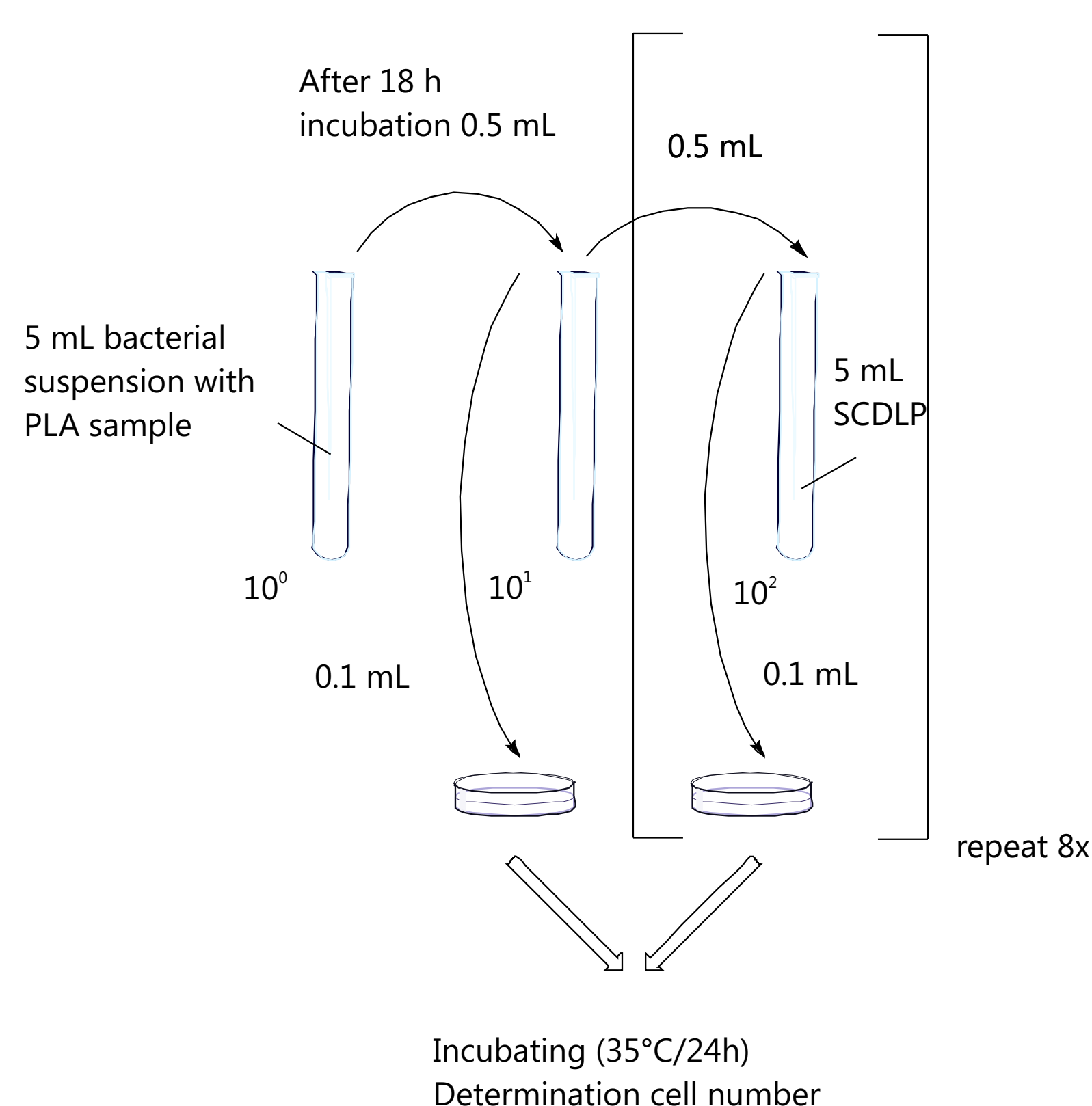
Introduction

Biocomposite materials are among the most promising material for the production of environmentally-friendly biodegradable packaging materials in food and health application. In this research we have carried out bulk modification of PLA to achieve antimicrobial functionality. Antimicrobial PLA would prevent the formation of biofilm and improve its utility especially in biomedical and food packaging applications.

Materials and Methods



Antimicrobial activity of PLA films were measured against Gram-positive bacteria *Staphylococcus aureus* (ATCC6538) and Gram-negative bacteria *Escherichia coli* (ATCC 8739), using a standard test ISO 22196 : 2007, based on the viable cell count method.



Antimicrobial activity

Antimicrobial agents are those that kill or inhibit the growth of micro-organisms. To effectively inhibit microorganism growth, the antimicrobial agent must interrupt the growth cycle. The two tested bacteria applied in the study showed different sensitivity to the bulk modified PLA films: *Escherichia coli* was very sensitive with PLA/PEG/0.6SBCA and PLA/GA/0.6SBCA films > 5 log reduction (Fig.1), whereas *Staphylococcus aureus* was sensitive with PLA/GA/0.6SBCA films > 4 log reduction (Fig.2).

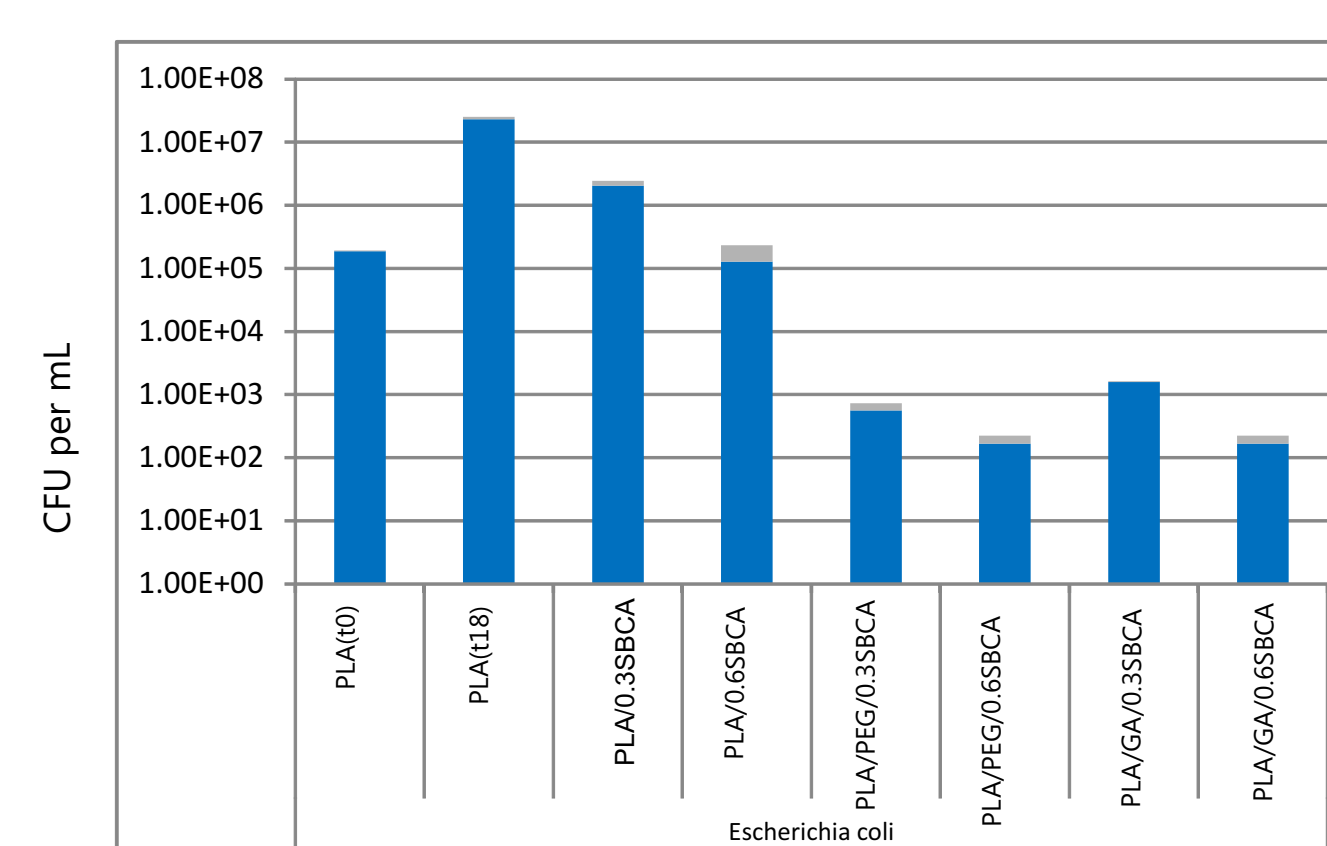


Fig. 1: Antimicrobial activity of PLA materials with bulk modification

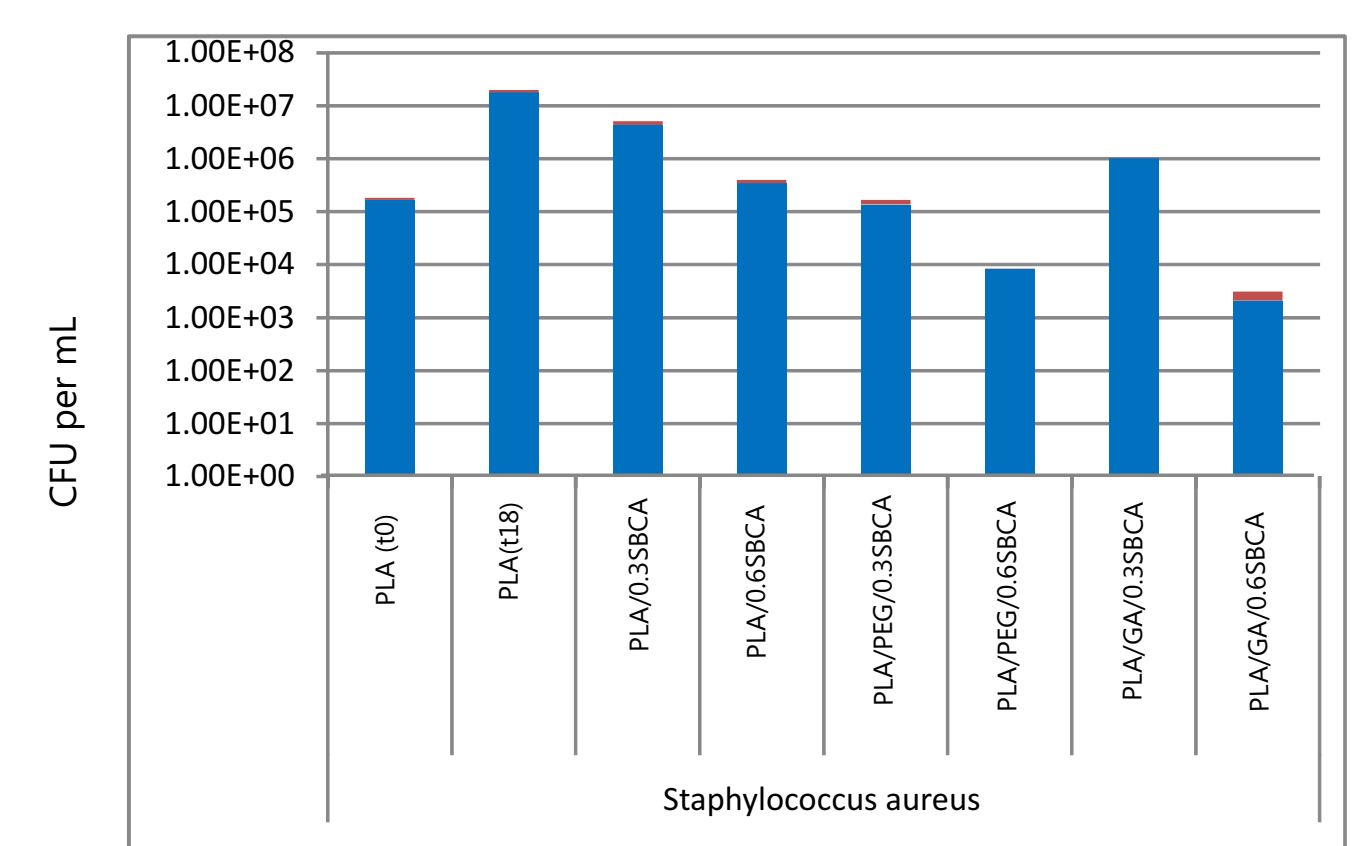
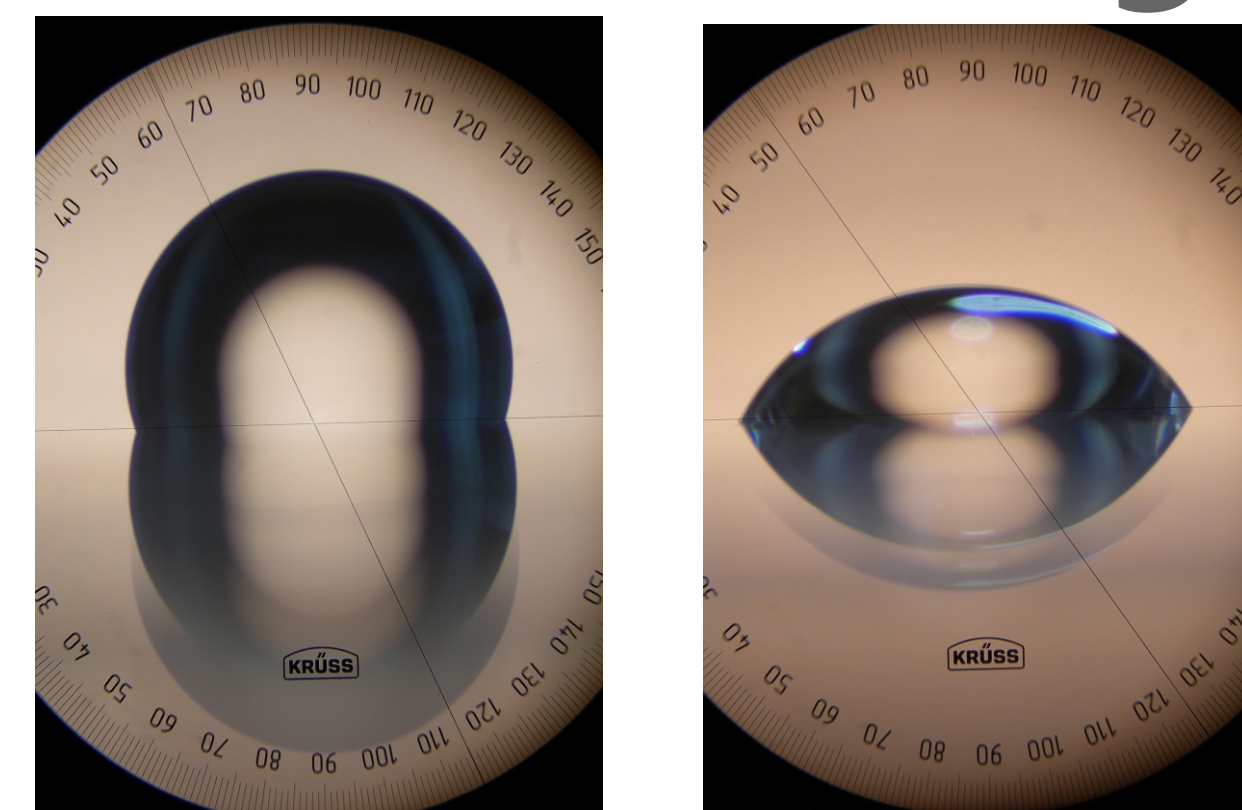


Fig. 2: Antimicrobial activity of PLA materials with bulk modification

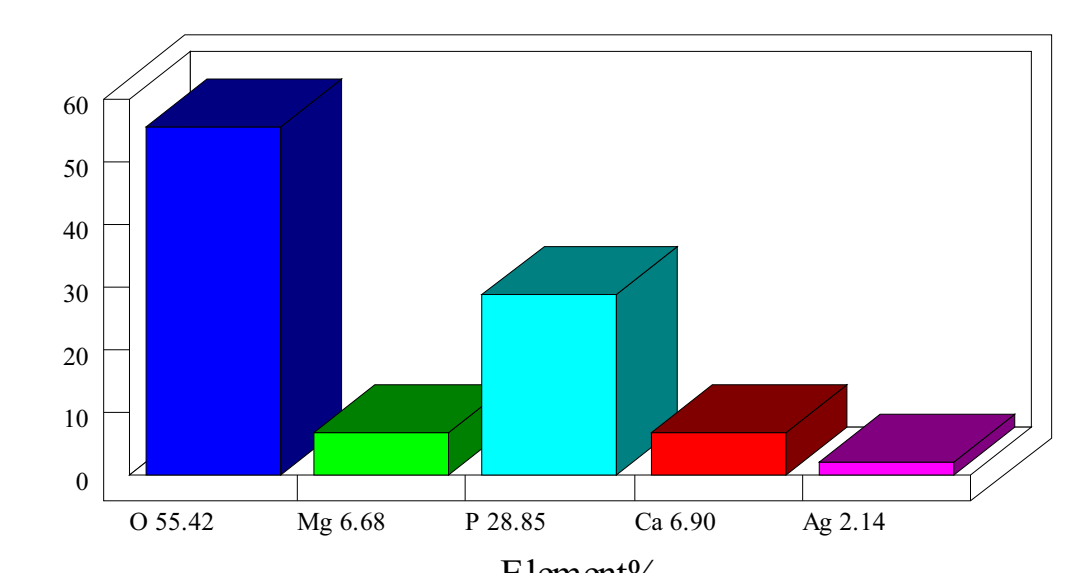
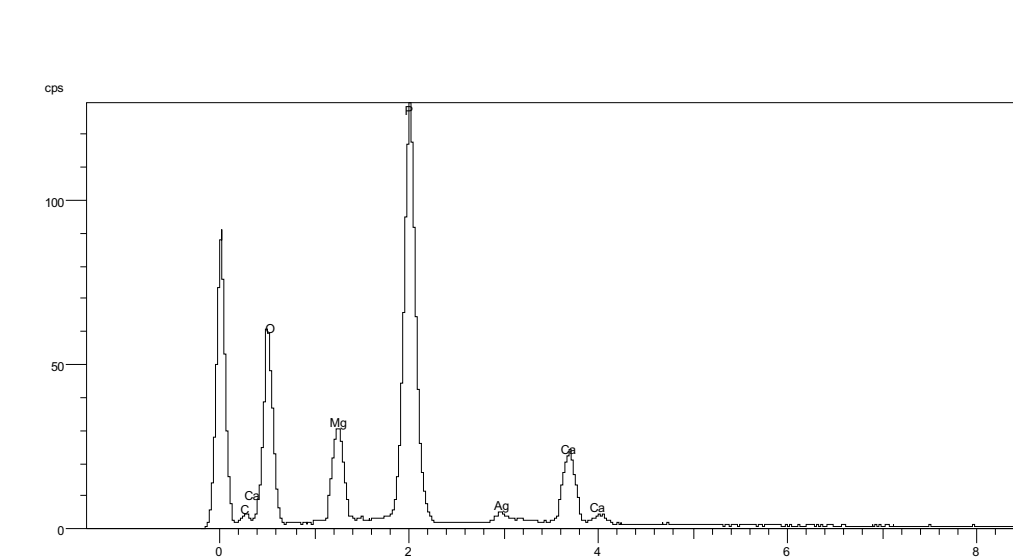
Contact angles



Addition of glycerol (GA) and polyethylene glycol (PEG) significantly reduced the contact angles of modified PLA films from 70° for unmodified PLA to 40° for modified PLA.

EDX analysis

EDX investigations for Sanitized® BC A 21-61 were applied in combination with a scanning electron microscope (Amray) in ECO mode. The EDX spectra were taken at a magnification 1500 and other parameters in the EDX investigation were an acceleration voltage of the electron beam of 20 kV.



Conclusions

Silver (Ag) is an efficacious and useful antibacterial agent. Small amounts of silver already show antibacterial properties. The bulk modified PLA films with hydrophilic additives were particularly efficient against *Staphylococcus aureus* and *Escherichia coli* which are opportunistic pathogens and these bulk modified PLA films might find future application in biomedical and food packaging areas.

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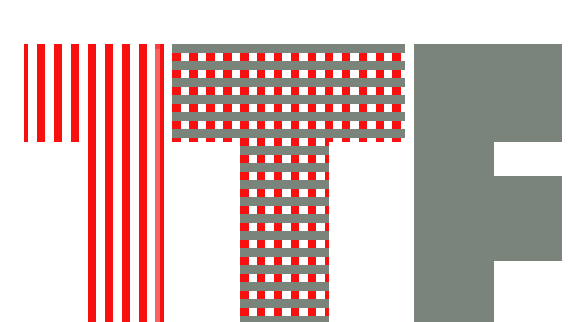
References

¹Gupta,B.; Revagade,N.; Hilborn, J.: Poly(lactic acid) fiber: An overview, Prog. Polymer Sci., 32 (2007), pp. 455-482

²ISO 22196:2007, Measurement of antibacterial activity on plastics surfaces

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The research leading to these results has received funding from the European community's Seventh Framework Programme (FP7/2007-2013) for the CSA action FP7-REGPOT-2008-1: T-Pot under grant agreement no. 229801 and EMPA, Swiss Federal Laboratories for Materials Testing and Research.



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