PRINTABILITY OF MUCOADHESIVE SODIUM ALGINATE/CHITOSAN GELS DELIVERING PHOTOSENSITIZER IN PHOTODYNAMIC THERAPY

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Additive technologies have propelled the popularity of personalized medicine, expanding the adaptation of various biomaterials for incremental processing. Current research focuses on additive manufacturing of drug carriers and active substances for different therapies, e.g. photodynamic therapy (PDT), an increasingly common non-invasive approach for mucosa lesions. Sodium alginate (SA) and chitosan, natural-based, biocompatible polymers, exhibit the potential to deliver active substances [1-2]. The mucoadhesive properties of chitosan make it suitable for drug delivery through the mucosa, while the SA solution shows excellent printability [3].

This study aimed to determine how the addition of adhesion-enhancing chitosan and photosensitizer affects the printability of sodium alginate gels. Additionally, the influence of printing parameters - speed and pressure of the print head on printing accuracy - was examined. The study took into account the effect of printing speed (5, 7, 10 mm/sec), pressure (80-120 kPa), chitosan concentration (0%, 3%, 4%, 5%, added to SA in 1:2 mass ratio) and the presence of methylene blue on printing accuracy. To assess the quality of prints, the expansion coefficient (α) was used which determines the ability of the material to flow on the substrate on which it is deposited after printing.

Results indicate that chitosan enhances printing accuracy (Figure 1), but its excessive concentration causes nozzle clogging. MANOVA analysis shows that the spread of ink on the substrate is influenced by both the pressure and the head feed speed. The addition of a photosensitizer does not impact printing accuracy. Chitosan with mucoadhesive properties positively influences the printability of alginate ink with proper concentration adjustment. Research results show the possibility of the usage of sodium alginate/chitosan inks in applications where adhesion to the mucosa is required while at the same time ensuring high print quality. Moreover, the addition of methylene blue does not adversely affect printability, therefore this type of ink can be used as a photosensitizer carrier in PDT.

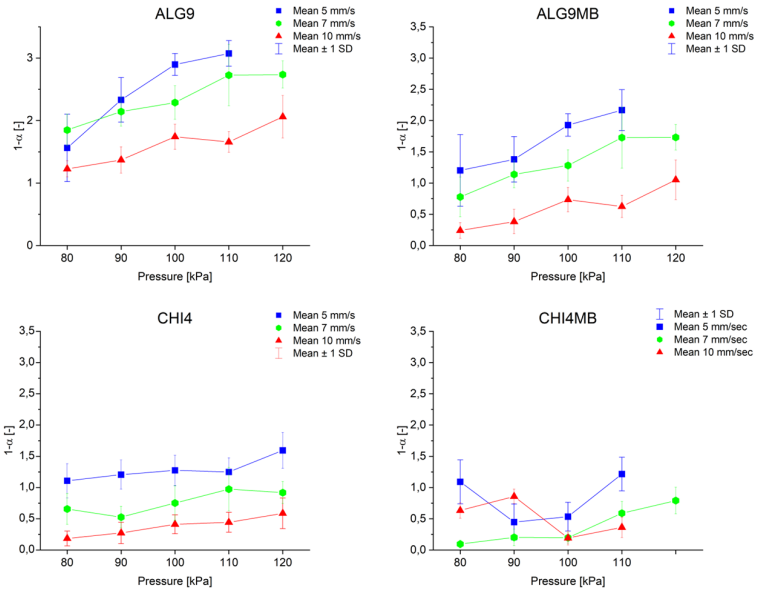

Fig. 1. Expansion ratio depending on pressure and printing speed for sample study groups

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