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Selection of a Nanocellulose-Reinforced PVA/PVP Hydrogel

A case study illustrates the application of a structured approach and tools to identify a new hydrogel for human cartilage replacement. These materials have multiple properties of interest, so selecting a new material (hydrogel) is a multi-attribute decision-making problem. Ten hydrogels, most of which are new formulations, were evaluated based on three attributes. The weights assigned to the attributes were identified using three methods from the literature, in addition to those previously assigned by an expert. Since the hydrogel properties showed some variability, Monte Carlo simulations were carried out using triangular distribution. Ten thousand decision matrices were built and 10,000 rankings were generated by each of the ten multi-criteria decision-making methods employed in this study. Ranking similarity was evaluated through the PS index, whose values ensure consistency and reliability of the results achieved. Rank acceptability and pairwise indexes were used to identify the most promising hydrogels. Two hydrogels were identified as the most promising for further study, for any of the four sets of weights used. Both are annealed nanocellulose-reinforced polyvinyl alcohol and pyrrolidone hydro-gels. The robustness of this result is supported on the values of acceptability and pair-wise indexes.

Special/ Invited session

Classification

Both methodology and application

Keywords

biomedical; cartilage; decision-making; multi-attribute; Monte Carlo; similarity-pairwise index

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