

Determination of optimal synthesis conditions of the Cu@PET composites using Taguchi robust experiment design

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In this task the Taguchi robust design was applied to optimize experimental parameters as well as to determine the optimal conditions for the electroless copper plating. Taguchi robust planning is widely used in the production and study of various technological processes and scientific research, including synthesis of nanomaterials and the study of their properties. Orthogonal array of L₂₇ type was applied as an experimental design to analyze the results and to determine optimum conditions for synthesis of copper microtubes loaded composite membranes. Four key process parameters – deposition temperature, amount of activation, amount of formaldehyde and concentration of carboxylic groups on the PET template surface – were considered for the optimization of Cu@PET composites as an efficient catalyst in the methylene blue decomposition reaction.

The signal-to-noise (S/N) ratio analysis is adapted to improve the statistical properties of the Taguchi design method used in this work to evaluate the conditions required to obtain composite TeMs with the highest photocatalytic activity. In this study, for measurable quality characteristics, the equation “larger-is-better” was used.

Optimal conditions for the sunthesis of Cu@PET composites according to obtained results were determined: carboxylic group concentration - 16.5 ± 1.5 nM/cm², deposition temperature – 25 °C, plating time – 20 min and reducing agent (formaldehyde) concentration – 5.95 ml/l.

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