

ARTIGO - BIOTECNOLOGIA

**SENSORS PRODUCTION: PROCESS STATISTICAL ANALYSIS AND
ARTIFICIAL INTELLIGENCE FOR QUALITY CONTROL**

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Screen printing is an economical, practical, and sustainable alternative for sensor production. Screen-printed sensors are a fundamental component of biosensors, which act as diagnostic devices, and therefore need to meet high standards of quality and performance. This work aimed to study a company production process (Biosens) of screen-printed sensors through statistical analyses of the process yield and the final product's thickness. In addition, it aimed to apply Artificial Intelligence for visual inspection based on machine learning, in order to automate and accelerate the decision to approve or discard the product. The company provided production data from March to July 2024,

totaling five production batches. Generalized linear mixed models with a binomial family were used to analyze yield and manufacturing errors, performed in RStudio software ($\alpha=0.05$). Success proportions were evaluated through their logit values, variance and confidence interval obtained from the model and logistic distribution. Control and Pareto charts were applied to analyze product thickness and manufacturing errors, respectively. Additionally, a computer vision model based on a pre-training neural network was developed in Python for automating the product inspection process using sensor's images to classify manufacturing errors. It was observed that the Biosens' screen-printing process had a yield of 41.5%, with the main errors being rejections due to unprinted tracks, tracks wider than standard and paste accumulation during printing. The developed computational model presents itself as a promising tool with 83% efficiency in precision, recall, and F1-Score metrics when tested in the production process.

Palavras-chave: sensors; screen-printing; production process; statistical analysis; statistical process control; artificial intelligence; neural network.