IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 3, November 2025
Impact Factor: 7.67

A Review on Integration of Artificial Intelligence (AI), Machine Learning (ML), and Big Data Analytics in Pharmaceutical Quality Assurance & Quality Control

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Abstract: *There is growing demand on the pharmaceutical sector to improve product quality, guarantee regulatory compliance, and optimize production procedures. One revolutionary way to deal with these issues is the incorporation of automation and artificial intelligence (AI) in pharmaceutical quality assurance (QA). The uses, advantages, and constraints of AI and automation technologies in pharmaceutical quality assurance are examined in this paper. Automation systems are used to lower human error, increase productivity, and guarantee consistent product quality. Examples of these systems include robotic process automation (RPA), automated testing platforms, and data monitoring tools. More precise data analysis, real-time decision-making, and predictive maintenance are made possible by AI technologies including machine learning (ML), natural language processing (NLP), and predictive analytics Innovations have improved regulatory compliance, shortened time to market, and decreased operating expenses. Regulatory issues, interoperability with old systems, and high implementation costs are still obstacles. Future developments in AI and automation in pharmaceutical quality assurance are anticipated to include block chain integration for traceability and AI-driven quality control.*

Keywords: Artificial intelligence, Pharmaceutical Sector, Drug Development, Research and development, Manufacturing, and Quality control, Machine Learning, Big Data Analytics

DOI: 10.48175/IJARSCT-29821