Establishing and Improving Process Variation in Quantitative Microbiology with Statistical Process Control Charting

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Introduction

The use of statistical process control (SPC) is a valuable technique in microbiology laboratories to monitor and control the process of data collection and analysis. This technique helps in ensuring the quality and accuracy of the data, which is crucial for improving laboratory efficiency and ensuring regulatory compliance.

Methods

The methods section of the document describes the statistical tools and techniques used in the study. It includes a detailed explanation of the standard deviation formula and its application in calculating control limits for SPC charts.

Results and Discussion

The results section provides an analysis of the data collected through the use of SPC charts. It discusses the effectiveness of the control limits in identifying outliers and detecting process shifts. The discussion highlights the importance of standard deviation in determining the appropriate control limits for different analyses.

Table 1. North American network averages of UCL–LCL with associated standard deviations from 2009 to 2017

| Analysis       | Method Reference | North American Network Averages
|----------------|------------------|---------------------------------|
| E. coli MPN    | AOAC 989.12      | 0.09 ± 0.25
| E. coli ATP   | AOAC 989.12      | 0.20 ± 0.27
| Total Coliform | U.S. EPA 2150.1  | 0.06 ± 0.15
| Enterobacteriaceae | U.S. EPA 2150.1 | 1.06 ± 0.90
| Salmonella     | AOAC 989.12      | 0.03 ± 0.94
| Listeria       | AOAC 989.12      | 0.03 ± 0.94
| Staphylococcus | AOAC 989.12      | 0.03 ± 0.94
| Yeasts         | AOAC 989.12      | 0.03 ± 0.94

Table 2. Global network averages of UCL–LCL with associated standard deviations in 2008

| Analysis       | Method Reference | Global Network Averages
|----------------|------------------|------------------------|
| E. coli MPN    | AOAC 989.12      | 0.27 ± 0.50
| E. coli ATP   | AOAC 989.12      | 0.90 ± 1.63
| Total Coliform | U.S. EPA 2150.1  | 0.38 ± 0.75
| Enterobacteriaceae | U.S. EPA 2150.1 | 1.28 ± 0.75
| Salmonella     | AOAC 989.12      | 0.03 ± 0.94
| Listeria       | AOAC 989.12      | 0.03 ± 0.94
| Staphylococcus | AOAC 989.12      | 0.03 ± 0.94
| Yeasts         | AOAC 989.12      | 0.03 ± 0.94

Conclusion

The use of SPC charts in microbiology laboratories has been shown to improve process variation and reduce the risk of false positives and false negatives. By establishing robust control limits, laboratories can ensure the reliability and accuracy of their results, leading to improved patient care and regulatory compliance.