



Mycotoxins 2018:

Fit For Purpose σ Review

Do we inform or do we instruct?





The Role of ffp σ in Z Scores for the Mycotoxin PT Scheme

Z is a Normalized measure of where you stand relative to the other participants in the scheme. ffp σ is the normalizing factor.

$$Z = \frac{x_{\text{LAB}} - X_{\text{AV}}}{\sigma_{\text{ffp}}}$$

- Measured as the difference between your analysis (x_{LAB}) and our best estimate of the true analyte concentration (X_{AV}) described as the Assigned Value.
- And here's the issue: This difference is divided by the Modified Horwitz SD (σ_{ffp} is σ_{Modified Horwitz}).





How ffp σ Affects Z Scores in the Mycotoxin PT Scheme

We are currently using the Thompson (January, 2000) Modified Horwitz %RSD to estimate the fit-for-purpose SD in the Mycotoxin scheme.

$$\mathsf{Z} = \frac{\mathsf{X}_{\mathsf{LAB}} - \mathsf{X}_{\mathsf{AV}}}{\sigma_{\mathsf{Modified Horwitz}}}$$

 $\sigma_{Modified Horwitz}$ controls your Z score. If it is too low, you will get a higher (failing) Z. If it is too high, a lower Z and an artificial PASS.



Horwitz Trumpet

Thompson Modification (January, 2000)



 $\sigma_{\rm R}$ = 0.22 x C

%RSD = 22

if C < 1.2×10^{-7} $\sigma_{\rm R} = 0.02 \ x \ C^{0.8495}$ % RSD = 2 x C^{-0.1505}if $1.2 x 10^{-7} \le C \le 0.138$ $\sigma_{\rm R} = 0.01 \ x \ C^{0.5}$ % RSD = C^{-0.5}if C > 0.138



















Back to the Original Horwitz Approach J. AOAC, 1980

Relationship between σ (Reproducibility SD) and concentration C (mass fraction).

 $\sigma = AC^B$ Where A and B are constants

$$Log(\sigma) = Log(A) + B \times Log(C)$$

Straight line plot of Log (reproducibility SD) vs Log (concentration) With Slope B and Intercept Log(A).

Original Horwitz Equation: $\sigma = 0.02 \times C^{0.8495}$ %RSD = $2 \times C^{-0.1505}$











Effect of New Horwitz Proposal on Z Scores

Based on 2,400 Z Scores over 3 Years

| Z Option | Modified Horwitz | | New Proposal | |
|-----------|------------------|-------|--------------|-------|
| Action | 302 | 14.4% | 127 | 6.0% |
| Warning | 277 | 13.1% | 95 | 4.5% |
| Compliant | 1,529 | 72.5% | 1,886 | 89.5% |
| | | | | |
| 14.49 | Petfood Schemes | | | |







In Summary:

- Horwitz not necessarily "one-size-fits-all" approach.
- Our 137 Mycotoxin data points indicate a strong linear log-log relationship different to Horwitz.
- I suggest we implement the "New Proposal" as a "Fitness-For-Purpose" function for AAFCO Mycotoxins.

> %RSD = 21 x C^{-0.0271}.

 I recommend "tune ups" every couple of years to refine the relationship, until we reach a point of diminishing returns.

Stould we Droceed?

The question is, "do we inform or do we instruct?"