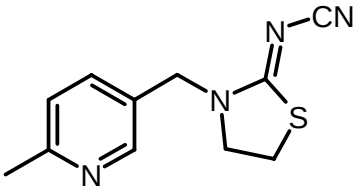
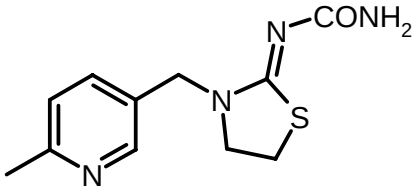
RSC | Advancing the Chemical Sciences

CuSum Chart Example

An agrochemical company produces thiocloprid, a neonicotinoid class insecticide, effective against aphids.



Thiocloprid



Amide impurity

Government regulations state that the product must contain a maximum level of 10 g kg^{-1} of the amide impurity. The company attempts to meet the amide impurity maximum level by setting a manufacturing specification of 8 ± 2 g kg^{-1}. Analysis data for 10 batches of product are shown in the Table below.

Batch Number	1	2	3	4	5	6	7	8	9	10
Thioclopid / g kg^{-1}	980	976	983	975	976	979	982	975	978	976
Amide impurity/g kg^{-1}	8.2	9.3	7.2	8.2	8.3	7.6	8.5	9.2	9.6	9.9

Assume that the data for both compounds approximate to normal distributions and that a 95% probability level is required in calculations.

(a) Calculate the mean and standard deviation of the thiocloprid data.

(b) Calculate the *confidence* and *tolerance limits* for the amount of thiocloprid and interpret their values (***see section on Confidence Limits***).

(c) Using graph paper, prepare a CuSum chart of the amide impurity level over the 10 batches of product. Interpret your chart.

(d) All of the 10 batches are within the amide impurity specification limits for the regulations. However, two distinct regions should be apparent on your CuSum chart from part (c). Using information obtained from the chart (not from the Table of data) determine the mean amount of amide impurity present in products manufactured during both regions.

(e) Prepare a V-mask for the CuSum chart on the same graph paper as the chart. Assume that each analysis value is the mean of 5 repeat measurements with a standard deviation of 0.70 g kg^{-1}. Describe how the V-mask may be used to show whether the process is under statistical process control.