S.O.S. IN ENVIRONMENTAL CHEMISTRY
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CONCEPT OF VALIDATION

INTRODUCTION

Validation is defined as “A Documented Programme , which provides a high degree of assurance that a specific process will consistently produce a product meeting its pre-determined specifications and quality attributes”.

Validation is the process of evaluating products or analytical methods to ensure compliance with products or cleaning method requirements

Action of proving and documenting that any process, procedure or method actually and consistently leads to the expected results

TYPES OF VALIDATION

Prospective validation:

It is conducted prior to the distribution of either a new product or a product made under a modified production process, where the modifications are significant & may affect the product characteristics.

• It includes:

☐Initial stages of formulation development & process development

☐Setting of process sampling plans

☐Designing of batch records

☐Defining raw material specifications

☐Transfer of technology from scale up to commercial size batches

☐Environmental controls

Concurrrent validation:

It is a process where current production batches are used to monitor processing parameters.

• It gives of the present batch being studied, and offers limited assurance regarding consistency of quality from batch to batch. Examples of these may be when:

• A previous validated process is being transferred to a third party contract manufacturer or to another site.

• The number of batches produced are limited

• Process with low production volume per batch and market demand

• The product is a different strength of a previously validated product with the same ratio of active or inactive ingredients.

Retrospective validation:

It is conducted for a product already being marketed and is based on extensive data accumulated over several lots and over time.

• This validation may be used for older products which were not validated by the fabricator at the time that they were first marketed.

• Retrospective validation is only acceptable for well established detailed processes and will be inappropriate when there have recent changes in the formulation of the products, operating procedures, equipment & facility

• Some of the essential elements of this validation are:

- Batches manufactured for a definite period
- Number of lots released per year
- Master manufacturing/packaging documents
- List of process deviations, corrective actions & changes to manufacturing documents
- Data for stability testing for several batches

VALIDATION PARAMETERS

1) ACCURACY: The accuracy of an analytical procedure expresses the closeness of agreement between the value which is accepted either as a conventional true value or an accepted reference value and the value found. This is sometimes termed trueness.
2) PRECISION: The precision of an analytical method refers to the closeness of values obtained from a series of tests. The precision of an analytical procedure expresses the closeness of agreement (degree of scatter) between a series of measurements obtained from multiple sampling of the same homogeneous sample under the prescribed conditions.

Precision may be considered at three levels:

• INTERMEDIATE PRECISION: When the test is repeated on different days by different persons or using different instruments within the same laboratory, the variation is expressed in terms of intermediate precision.

• REPRODUCIBILITY: When a method is standardized, the test is carried out in different laboratories using the same method, the precision between the laboratories is referred to as reproducibility.

• REPEATABILITY: Repeatability is established when the same sample is estimated repeatedly by the same analyst using same analytical method within the same laboratory using same instrument and performed within a short period of time.

3) SPECIFICITY: Specificity is the ability of a test method to measure the analyte explicitly in the presence of other components which may be expected to be present. Typically these might include impurities, degradants, etc.

4) LINEARITY: Linearity of an analytical method refers to it's ability to measure a specific component within a range. The linearity of an analytical procedure is its ability (within a given range) to obtain test results which are directly proportional to the concentration (amount) of analyte in the sample. For the establishment of linearity, a minimum of 5 concentrations is recommended. The correlation coefficient, y-intercept, slope of the regression line should be submitted

5) DETECTION LIMIT: The detection limit of an individual analytical procedure is the lowest amount of analyte in a sample which can be detected but not necessarily quantitated as an exact value

6) QUANTITATION LIMIT: The quantitation limit of an individual analytical procedure is the lowest amount of analyte in a sample which can be quantitatively determined with suitable precision and accuracy.

7) ROBUSTNESS : The robustness of an analytical procedure is a measure of its capacity to remain unaffected by small, but deliberate variations in method parameters and provides an indication of its reliability during normal usage.

8) RANGE: The range of an analytical procedure is the interval between the upper and lower concentration (amounts) of analyte in the sample (including these concentrations) for which it has been demonstrated that the analytical procedure has a suitable level of precision, accuracy and linearity

PROCESS RE-VALIDATION : Process re-validation is required when there is a change in any of the critical process parameters, formulation, primary packaging components, major equipment or premises

when process re-validation is required when:

- Changes in raw materials (physical properties such as density, viscosity, particle size distribution)
- Changes in source of active raw material manufacturer
- Changes in packaging material (primary container/ closure system)
- Changes in the process (Mixing time, drying temperatures & batch size)
- Changes in the equipment
- Changes in the plant/facility

REASONS FOR VALIDATION

- Customer satisfaction: Non-conforming product can lead to lost customers.
- Product liability: Conformance to product specifications must be maintained.
- Reduced production costs: PV leads to reduced inspections, testing, scrap and rework. Shifts costs from production to prevention.
- Supports improvements: Testing data can be used to support improvements in the process or the development of the next generation of the process.
- Regulatory requirement