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COMPLETE REVIEW OF QUALIFICATION OF AUTOCLAVE

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➢ ***Abstract:*** *According to GMP, the qualification and validation of autoclave is important in pharmaceutical industry. autoclave is used for sterilization of food, equipment ,dresses and medicinal product for avoid the contamination from spores , microorganism, pathogen and bacteria.every pharmaceutical company need of qualification prove that critical operation control by qualification.qualifiaction is integral part of GMP. Every key point are explained in define and documentation . Now a day qualification is mandatory in manufacturing pharmaceutical company. Complete review of qualification of autoclave in that also contain basic qualification USR ,DQ,IQ,PQ and OQ. And also contain autoclave loading and unloading area, operation of autoclave, then also maintain difference test for periodic validation vacuum test , Bowie-Dick Test, heat distribution and penetration study (Maximum and minimum load).*

➢ ***Keywords:*** *Autoclave Qualification , Sterilization ,Validation ,Heat penetration , Heat distribution, operation of Autoclave ,Vacuum test and Bowie-Dick test..*

➢ Introduction:

Definition :

1. **Qualification:** Identification of particular attribute of equipment utilities or processed related to the performance of a particular function such as design (DQ),Installation or operation and the allocation of certain limit or attributes to those and finally the measurement of those attributes in range for those functions. Any equipment action of providing to working correct and actually lead to result.

2. **Validation:** Documented testing performing under highly controlled condition, demonstrating that process, method and system consistently produce result meeting pre-determined acceptance criteria.

3. **Sterilization**: The destruction of all living microorganism such as pathogenic or saprophytic bacteria ,vegetative form and spores.
    1. Articles that have been sterilized can be used for aseptic purpose in all areas.

4. **Autoclave:** Autoclave is equipment that make use of pressurized steam in order to eliminate microorganisms. It is also used in sterilization of medical application .used in chemical industry for sterilization of vulcanizing rubber ,curing composites and hydrothermal synthesis.

- **Need and Importance**
  1. Autoclave are known as steam sterilizers, it is used for healthcare and industrial applications
  2. It can also uses steam under pressure to kill harmful bacteria, virus, fungi and spores on items.
  3. Autoclave used to sterilize surgical equipment, laboratory instruments, pharmaceutical item and other materials.
  4. It also sterilize solid ,liquid ,hallows and instruments of various shape and sizes

- **Basic Qualification Approach**

User Requirement specification: The set of owner, user and engineering requirements necessary and sufficient to create a feasible design meeting the intended purpose of the system.

1) **Design Qualification (DQ):** The documented verification that the proposed design of facility, system and equipment is suitable for intended purpose.
2) **Installation Qualification (IQ):** The documented verification that the facility, system and equipment as installed or modified comply with approved design and the manufactures' recommendations.
3) **Operational Qualification (OQ):** The documented verification that the facility, system and equipment as installed or modified performance as intended throughout the anticipated operating ranges.
4) **Performance Qualification (PQ):** he documented verification that the facility, system and equipment as connected together , can perform effectively and reproducibly ,based on approved process methods and products specifications.

- **Loading of autoclave:**

1) To take line clearance new batch start, before to check previous products not available in loading side area of autoclave.
2) Fill bags in tray of empty trolley , then complete lot.
3) In case of validation, data tracer and biological indicator can be used in non-sterile bags then in trolley.
4) To stick steri. tape of every trolley of lot with proper labelling.
5) Then fill lot loaded in autoclave before check line clearance of chamber.
6) To fill log book before start of load.

- **Operation of autoclave:**

Sterilizer is designed based on F_0 concept .then using utility required raw steam , compressed air , purified water ,cooling water and electricity.
Autoclave sterilization cycle consist:

1) Filling phase
2) Heating
3) Sterilizating phase
4) Cooling phase
5) Drain off

- **Unloading of autoclave:**

a. After sterilization lot can be unloaded to unloading side area.
b. To check steri tape colour change white to grey after sterilization.
c. Unloaded lot can be packaging in packaging area.

- **The Different Tests Are Performed For Periodic Validation Of Autoclave:**

1) Vacuum leak test
2) Bowie-Dick Test
3) Heat Distribution Study
4) Heat Penetration Study

1) **Vacuum Leak Test:**
   a) **Objective:** To ensure that the leakage of vacuum in sterilization chamber during vacuum hold time when the sterilizing chamber is empty.
   b) **Principle:** These tests are show that the sterilizer chamber does not leak in empty chamber. have a two reasons leakage of air
      a. Presence of air inhibits penetration of load by steam and prevent sterilization.
      b. Drying cycle are not passed through the bacteria retentive filter therefore there is a risk of contamination of load.

Procedure: To ensure that chamber temperature is stable at ambient and compressed air with high pressure ,then ensure that gasket of chamber lubricant is proper. Than start the vacuum test cycle. After that observe pressure in pressure gauge of steam sterilizer. And cycle allow pressure drop down. Then machine will close all valve connect to chamber of steriliser stop vacuum pump then note the time and pressure (P_1).after that wait 5min (±10sec.)and note down pressure again (P_2) and wait another 10 min(±10sec.)and note down the pressure third time (P_3) return to atmosphere pressure and continue to run cycle. Then vacuum leak rate should not more than acceptance criteria.

c) **Acceptance Criteria:** Vacuum leak rate should be NMT 0.013 bar/ 10min

2) **Bowie-Dick test:**
   a) **Objective:** To ensure that the vacuum pulses applied before the sterilization hold period are removed the entrapped air or non-condensable gases to facilitate the event and rapid steam penetration into chamber and maintaining this condition at time of sterilization holding time.
   b) **Principle:**
      (i) Sterilization is achieved by rapid and even penetration of steam into all parts of lod and maintaining of condition for specified holding time.
      (ii) To ensure that, to remove air from chamber ,to provide a steam supply which contains minimum volume of non-condensable gases.
      (iii)Bowie-Dick test shows whether or not steam penetration is taking place by testing in presence of non-condensable gases in chamber , but does not confirm that the sterilization condition in load is achieved or not.
   c) **Procedure:** Place the Bowie Dick test paper on the bottom area of the Autoclave just above drain point (100mm over the drain) .then Air removal study shall be performed in empty chamber by keeping the Bowie Dick test paper. It contain of standard paper pack and indicator sheet. Then Start the cycle. After that the cycle is end then open the door and take the sterilized test paper from the autoclave and to ensure the indicator paper for uniform colour change As Bowie Dick test paper is designed to simulate the garment pack, it used to test for the air removal from the steam sterilizer Three cycle run of air removal study shall be performed by using fresh indicator paper This test shall be performed by Bowie Dick test cycle. To sterilization cycle shall have 17 minutes at 121°C to 123°C sterilization period.
   d) **Acceptance Criteria:** Bowie-Dick indicator should show uniform colour change yellow to brown/black over entire pattern of indicator sheet.

3) **Heat Distribution Study (Empty Chamber):**
   a) **Objective:**
      (i) to verify the temperature uniformity in throughout chamber
      (ii) to identify the cold spot in empty chamber
      (iii)attaining a set temperature throughout the sterilizing hold period
   b) **Procedure:** Temperature sensors inside through validation port and seal the port with silicon sealant to ensure that no steam leakage during operation. Set the calibrated thermocouple (T-type) inside the sterilizer chamber as per defined location , probe should not touch the internal wall of chamber. set the internal resistant of RTD (Accuracy ±0.5°C) probe in data logger and other parameter. When using appropriate number of data tracer as per-defined(Maximum 10%)
      of data tracer can fail. Then cold spots location must be functional. Equilibrium Time is the time difference between in minute when first sensor reached at set temperature and last sensor reached at set temperature. calculate equilibrium time in heat distribution

c) Acceptance Criteria:

i. At sterilization temperature reading of each thermocouple sensor is within $\pm 1^0$C
ii. Should not differ from one another by more than 2^oC
iii. All sterilization phase, temperature variance between reference/control sensor and external sensor should not differ from one another by more than 3^oC
iv. At sterilization phase all temperature are within at 121^0c ($\pm 2^0$c ,-1^oc)

4) Heat Penetration Study (Maximum and Minimum Load):

a) Objective: To study is conducted to ensure that the coolest unit within a pre-defined loading pattern will consistently be exposed to sufficient heat lethality and to verify sterilization has been reached in each load.

b) Procedure: : Temperature sensors inside through validation port and seal the port with silicon sealant to ensure that no steam leakage during operation. Set the calibrated thermocouple (T-type) inside the sterilizer chamber as per defined location , probe should not touch the internal wall of chamber. set the internal resistant of RTD (Accuracy $\pm 0.5^o$C) probe in data logger and other parameter. Arrange load specified keep at 21 biological indicator and 21 thermo chemical indicator each every cycle. In also one negative biological indicator used. Identification of cold point and find external temperature shall be placed at drain point keep at indicator and temperature sensor separately .operation of program and start of data logger have start simultaneously for cycle record. When using appropriate number of data tracer as per-defined(Maximum 10%) of data tracer can fail. Then cold spots location must be functional.after sterilization cycle is completed then stop data logger , open the autoclave ,to take biological indicator send to microbiological deparment for testing and to check steri. chemical indicator colour change .Maximum F_0 value will be determine stability of product.

c) Acceptance Criteria:

i. F_o value at any location including cold point at 121.5^oc is not less than 15 min. in products
ii. At sterilization phase temperature variance between reference/control sensor and external sensor should not differ from one another by more than 3^0c.
iii. Sterility assurance level (SAL) should be 10^{-6}

➢ **Conclusion:** Qualification is essential concept of cGMP. Autoclave is used for sterilization of medical product ,food and machine equipment, cleaning of filter and cleaning rubber stopper. This fallowed by performing basic qualification and the different test performed for periodic validation of Autoclave like vacuum test, Bowie-Dick test, heat penetration and distribution study. All parameter and process which are describe in within acceptance criteria. If Considered , autoclave is to be qualified and it can be routinely used.

➢ **Reference:**

i. Fernbach E, Joubert, Roux E, Pasteur E, Straurs, Charles chamberland, En collaboration arec, 1851-1908.
ii. Online etymology dictionary, available at www.etymonline.com
iii. Seymour S B, Disinfection, Sterilization and preservation, Lippincott Williams and wilkins, ISBN 978-0-683-30740-5, 2001.
iv. Thomas C., John P.J., Principles and Methods of Sterilization in Health Sciences, second ed., 1983.
v. Fabritz H, Autoclave Qualification and Validation, Expert raff 2007-14
vi. Validation of Steam Sterilization Cycles, Technical Monograph No.1, Parenteral Drug Association,Inc., Philadelphia, pp.5-6.
vii. European Committee for Standardization, Sterilization of Medical-Devices Validation and Control of Sterilization by Moist Heat Sterilization, EN 554:1994. pp. 264-269.