MANUFACTURING OF DRY POWDER INJECTION OF CETRIAXONE + SULBACTAM 1.5gm IP

An Internship report submitted for the

Partial fulfilment of the degree of Master of Science

By

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[M.Sc. Biotechnology]

Company name: Sanolet Life care Private Limited

Under the supervision of

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2022 – 23

Sanolet

Sanolet Lifecare Private Limited
CIN - U24304GJ2020PTC116691

DATE: 05th April 2023

CERTIFICATE

This is to certify that this training report entitled "**Manufacturing of dry powder injection of Ceftriaxone + Sulbactam 1.5gm IP**" was successfully carried out by **Miss. Nency Sudani** towards the partial fulfilment of requirements for the degree of Master of Science in Biotechnology of **Atmiya University, Rajkot.** It is an authentic record of her own work, carried out by her under the guidance of **Mr. Sukrut Patel** for a period of 3 months from 05th Jan 2023 to 05th April 2023 during the academic year of 2022-23. The content of this report, in full or in parts, has not been submitted for the award of any other degree or certificate in this or any other University.

We wish best of luck for her bright future.

Sanolet Lifecare Pvt. Ltd.

Authorized Signatory

SANOLET LIFECARE PRIVATE LIMITED · AHMEDABAD ·

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D E C L A R A T I O N

I hereby declare that the work incorporated in the present internship report entitled "Manufacturing of dry powder injection Ceftriaxone + Sulbactum 1.5gm IP" is my own work and is original. This work has not been submitted to any University for the award of any Degree or a Diploma.

5 April 2023 Nency Sudani

Date (Name and signature of Student)

ACKNOWLEDGEMENT

I consider it a great privilege & honor to have had the opportunity to undergo the industrial internship work in Sanolet Life Care Private Limited. Hence I would like to offer my heartiest thanks to Mr. Kiran Bunde (Managing Director, Sanolet Life Care Pvt. Ltd.

I convey my heartiest thanks to Mr. Sukrut Patel (Production Manager) for their most valuable suggestions, constant encouragement, and affectionate guidance during the period of these internship.

I would like to thanks all trainees and staffs, who help me very much and without whom support and guidance it was impossible for me to complete the internship successfully.

NENCY SUDANI

M.Sc. BIOTECHNOLOGY

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Abstract

- **Objective:**

1) To gather in depth information on manufacturing process
2) To analyse practical problem happening at production line.
3) To analyse process flow at production line and different documents used at specific points.
4) Overall learning on practical aspects of manufacturing process.
5) In depth learning of all concepts behind manufacturing process.

- **Information about report :**

- The starting part of the training involved visiting each department and getting overview from the Mr. Sukrut Patel production manager.
- For understanding the manufacturing process and documents, Rolling forecast data of 5 January 2023 to 5 April 2023 was collected and analysed.
- Documents of manufacturing process helps to understand actual procedure of Manufacturing process.

❖ COMPANY INFORMATION :

- Sanolet Life care Private Limited is a Private incorporated on 21 September 2020. It is classified as Non-govt. Company and is registered at Registrar of Companies, Ahmedabad. Its authorized share capital is Rs. 11,000,000 and its paid up capital is Rs. 10,100,000.

- Directors of Sanolet Life care Private Limited are Kiranbhai Kanubhai Bunde, Tejaskumar Maganlal Padodara, Hiren Vasantlal Shah and Sachin Ishvarbhai Sardava.

- Sanolet Life care Private Limited's Annual General Meeting (AGM) was last held on 30 November 2021 and as per records from Ministry of Corporate Affairs (MCA), its balance sheet was last filed on 31 March 2021.

✓ **Manufacturing process on Ceftriaxone & Sulbactam dry powder:**

- Ceftriaxone belongs to the class of medicines know as cephalosporin antibiotics. It works by killing bacteria or preventing their growth.

- Sulbactum is a beta-lactamase inhibitors antibiotic combined with other antibiotics to treat a variety of susceptible bacterial infections. Beta – lactamase, an enzyme produced by bacteria that destroys antibiotics activity.

- The rationale behind addition of sulbactam and disodium edetate (EDTA) with ceftriaxone was to provide multiple mechanisms of antibacterial actions. Sulbactam, can be effective against various beta lactamase producing microbes.

❖ **List of abbreviations :**

- PVT. – Private
- No. – Number
- Mfg. – Manufacturing
- MFR – Master Formula Record
- BMR – Batch Manufacturing Record
- IPQA – In Process Quality Assurance
- SOP – Standard Operating Procedure
- CAPA – Corrective Action and Preventive Action
- API – Active Pharmaceutical Ingredients
- BOM – Bill of Material
- RLAF – Reverse Laminar Air Flow
- UV – Ultra Violet
- Etc. – Et cetera
- PW – Purified Water
- PVC – Poly Vinyl Chloride
- IHS – In House Specification
- Exp. – Expiry
- QA – Quality Assurance
- QC – Quality Control
- LAF – Laminar Air Flow
- A.R. No. – Analytical Reference number
- RM – Raw Material
- IPA – Iso Propyl Alcohol
- RH – Relative Humidity
- NLT – Not Less Than
- WFI – Water For Injection
- PPM – Primary Packing Material

❖ **DEPARTMENTS IN COMPANY :**

1. Store
2. Production
3. Quality control
4. Quality assurance
5. Engineering

❖ **Store :**

- In store including :

1. Raw material,
2. Primary packaging material (PPM),
3. Secondary packaging material (SPM),
4. Tertiary packaging material (TPM).

1) **Primary packaging material :** Vials

Seal

Rubber Stoppers.

2) **Secondary packaging material:** label vials

Carton

Insert leaflet.

3) **Tertiary packaging Material:** Package

Plastic Shrink.

❖ **Production :**

- ✓ Providing information regarding the procedure currently adopted for manufacturing, operating equipment (sop) and any modification if required in the current procedure adopted for manufacturing operating equipment with justification.

➢ <u>Production Flow chart :</u>

Receiving Ceftriaxone 1000 mg & Sulbactam 500 mg order for 10000 vials

↓

RMS department where all Raw materials transport from warehouse now this material keeps in quarantine section.

↓

The entry of received material in register. And check the A.R No., Batch No., MFG and Exp. Date.

↓

QC department take material for sampling to check and the received material and label the containers or tanks as UNDER TEST.

↓

After test if material is ok then they labelled it is APPROVED. And if not labelled as REJECT.

↓

Approved material can transfer to Production department as per order received 10000 vials

↓

Dispensing of RM & PM

↓

De-cartoning of vials

↓

Washing of Vials

↓

Depyrogenation of vials

↓

Vial Filling & Stoppering

↓

Vial sealing machine

↓

Visual inspection

↓

Transfer to packing

✓ **process check parameters :**

- <u>Cleanliness of the area and line clearance :</u>

✓ Visually check area and equipment are cleaned and all cleaning records are filled.

✓ Ensure that temperature 24.0°c (23±5°c), RH 53% (50±5%) of the area is within the limit.

✓ Ensure that differential pressure of the room is within the limit NLT 10 Pascal.

✓ Ensure area is free from previous product.

- <u>Vial washing machine check point :</u>

✓ Vial washing with three type of water : Recycle water

Purified water

WFI water

- Compressed air pressure : NLT 1.0 kg/cm²
- Recycled water pressure : NLT 1.0 kg/cm²
- Purified water pressure : NLT 1.0 kg/cm²
- WFI pressure : NLT 1.0 kg/cm²

✓ <u>In process weight check :</u>

- Stranded weight to fill vial : 1.724 g
- Minimum weight to fill vial (-2%) : 1.689 g
- Maximum weight to fill vial (+2%) : 1.758 g

1. Leakage Test :

✓ It is desirable that all the parental preparation which are filled in vial must be hermetically sealed.

✓ The vial are immersed in 1% methylene blue solution in a vacuum chamber under negative pressure. When the vacuum is released the coloured solution will enter those vial having defective sealing. The presence of dye in the vial confirms the leakage and hence rejected.

2. Clarity check :

✓ Minimum 8 vials to be checked for clarity at interval 1hour.

✓ Particulate matter is define as unwanted insoluble matter other then gas bubbles present in the product. The presence of foreign matter in parenteral preparation is very dangerous especially when its particle size is larger than the RBC size. It can block the blood vessel.

- Particulate Matter : (A): ≥ 10 µm : ≤ 300 Pc/g

(B): ≥ 25 µm: ≤ 300 Pc/g

Figure No.: 1 clarity check

3. Bowie Dick Test :

- ✓ Done to check autoclave is working properly or not.
- ✓ The purpose of pressure and vacuum pulse is to effectively remove air from the chamber because air is a bad conductor of heat.
- ✓ Colour changes of indicators sheet is from red to black.
- ✓ If there is any problem in the autoclave colour will not change.

Figure No. : 2 Bowie Dick test

❖ **<u>Environmental monitoring:</u>**

- ✓ Environmental monitoring is the system allows pharmaceutical manufacturers to monitor and control the viable environmental contamination in their clean rooms.
- ✓ Settle plates typically consists of petri dishes filled with a culture media are opened and exposed to the air in different production area for specified period of time to determine what microbiological particle may be present in the environment , as they may settle out of the ambient air , and onto the media surface of the petri dish.
- ✓ These plates are then incubated and analysed.

❖ **Documentation work of manufacturing process :**

➢ BATCH MANUFACTURING RECORD (BMR) :

- A batch manufacturing record is a written record that document the entire manufacturing process and the history of a product batch.
- It include information about like product name, weight and records the entire production process, from start to finish.
- A good BMR format should contain following part :

1. **Batch Records :**
    - First page of the BMR has all records about the batch as batch number, product name, product code, batch size, composition, effective date, product description, product specification, standard batch size, Mfg. date, shelf life, actual batch size, expiry date.
2. **Abbreviation :**
    - List of the abbreviation used in the document should be made to understand the BMR easily.
3. **Bill of Raw material :**
    - In the bill of Raw material
    - Calculation of Raw material for fill weight.

Line Clearance:

- Areas and equipment should be cleaned.
- Ensure that Temperature & Relative Humidity of area is within the limit and recorder in BMR.
- Temperature : 21.4°C (23 ± 2°C)
- RH : 22% (20 ± 5%) of area
- Check differential pressure of dispensing area.
- Check cleanliness and qualification status of RLAF.
- Ensure all materials are approved from QC.
- Check utensil required for the dispensing and available & cleaned.
- Check that RLAF (Reverse laminar air flow) is switched on 30 min. before the dispensing activity.

4. **General instructions :**
    - All equipment used for manufacturing must be cleaned, dried and sterilized.
    - Stainless steel equipment are used.
    - All equipment must have proper guard and be earthed.
    - Operators must wear hand gloves and sterilized growing throughout the sterile area operations.
    - Necessary protection must be taken to avoid cross contaminations.
    - The relative humidity of whole sterile areas must be 20 ± 5% and temperature 23 ± 2°C.
5. **Equipment and machines cleaning records:**
    - Checklist of the cleaning of all equipment is prepared, those are used in the manufacturing of the batch including the previous products, batch and date of cleaning. Cleaning of the equipment should be checked by the quality assurance.
    - Name of equipment : Rotary vial washing machine
        - Sterilization and Depyrogenation tunnel
        - Vial filing and Rubber stoppering machine
        - Aluminium cap sealing machine
        - External vial washing machine
        - Double cone blender
        - Visual inspection booth
        - Weighing balance
        - Analytical balance – dynamic pass box (RLAF)
6. **Yield :**
    - Yield of the batch should be calculated at the end of the every stage to calculate the process loss. Final yield should be calculated at the end of the manufacturing that should not be less than 99.00%.
7. **Flip off seal sanitization record :**
    - Take dispensed flip off seal is SS container and sanitize the flip off seal using 70% IPA solution.
    - Keep all the SS container in sterile area under LA.

- Sanitized flip off seal be used within 48 hrs from the time of sanitization.
- Sanitization started on date and note the time.
- Sanitization completed on date and note the time.

8. **Environmental control of sterile area :**
    - Fogging status (Fogging with disinfectant solution containing 11% Hydrogen peroxide and 0.01% $AgNO_3$).
9. **Bill of primary packing material.**
10. **Glass vials washing.**
11. **Depyrogenation and sterilization of washed vials.**
12. **Flip off seal sanitization record.**
13. **Washing & sterilization of rubber stopper, blender and machine parts.**
14. **Environmental control of sterile area.**
15. **Equipment suitability record.**
16. **Weighing and bulk mixing record.**
17. **Filling and Sealing record.**
18. **Visual inspection and rejection record.**
19. **Batch reconciliation.**
20. **Batch yield details.**
21. **Batch summary report.**
22. **BMR review history :**
    - Review point
    - Signature of authorized persons

➢ <u>Contents and encloures.</u>

- RM dispensing slip
- Status of machinery
- Excess material issue
- Deviation and its justification
- Reconciliation and yields
- Legibility of contents

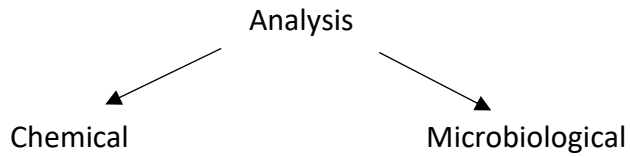
- BATCH PACKAGING RECORD (BPR) :
    - Batch packaging record is important document because it contains all information about the packaging process of the batch. It must contain everything about the packaging process.
    - Should be prepared for each batch of product.
    - Each Batch Processing Record should including the following :

1. **Batch Record :**
    - First page of the BPR has all records about the batch as batch number, product name, composition, store condition, effective date, shelf life, standard batch size, actual batch size, Mfg. date, expiry date.
2. **Abbreviation :**
    - List of the abbreviation used in the document should be made to understand the BPR easily.

3. **General instructions for packing :**
    - Inspect the pre-printed Mfg. licences number, batch number, Mfg. date, expiry date and MRP on each label of the vials.
    - Pack vials as per the MFR specification of packing.
    - Pack one vial in a carton and 10ml sterile water for injection IP ampoule.
    - Pack such monocartons in shrink bag and pass it through the shrinking machine.
4. **Bill of packing materials.**
5. **Overprinting of packing material record.**
6. **Specimens of printed packing materials.**
7. **Labelling and packing record.**
8. **Packing materials reconciliation record.**
9. **Batch yield details.**
10. **Dispatch log sheet.**
11. **Shipper number.**
12. **Batch summary report.**
13. **BPR review history.**

❖ **Quality control** :

- ✓ Providing information regarding the test procedure and equipment to be adopted to be used or to be developed for the testing of samples.
- ✓ Sampling of RM & Packing materials, analysing and result declaration all samples.
- ✓ To carry out environmental monitoring.
- ✓ Co-ordinating with the QA department during cross of investigation.
- ✓ Review and evaluation of batch analysis as well as preparation and approval of certificate analysis.
- ✓ Microbiology & Stability testing.



❖ **Review & Test of Material :**

Test	Result
1. Description	A white crystalline powder
2. Identification A. (By IR)	The infrared spectrum of sample should is concordant with the spectrum of the working standard of ceftriaxone sodium
3. Water content by Karl fisher	9.21 % (range: between 8.0 % to 11.0 %)
4. pH	7.38 (range: between 6.0 to 8.0)
5. Average weight	1072.56 mg (range: 1080.0 mg ± 2.0%)
6. Organic impurities a. Deacetylcefotaxime lactone b. Ceftriaxone triazing analog c. Ceftriaxone -3 ene isomer d. any individual unspecified impurity	 Not Detected (NMT: 0.5%) Not Detected (NMT: 1%) Not Detected (NMT: 0.3%) Not Detected (NMT: 0.2 %)
7. Bacterial endotoxins test	Less than 0.20 EU/mg (NMT : 0.20 EU/mg of ceftriaxone)
8. Bacterial endotoxins test	Less than 0.20 EU/mg (NMT : 0.20 EU/mg of ceftriaxone)
9. Sterility	Sterile

10.Tapped density	0.56 g/ml
11. Residual solvent acetone	879 ppm (NMT : 5000 ppm)

❖ **Equipment Use in QC :**

❖ Chemical section :

- pH Meter
- Bursting Strength Tester
- Centrifuge
- UV Cabinate (TLC)
- Hot Air Oven
- Muffle Furance
- Melting Point Apparatus
- Water Bath
- Polarimetry
- Vacuum Oven

❖ Instrument Room :

- HPLC
- Density Tester
- UV Spectrometer

❖ Microbiology Section :

- Laminar Air Flow
- 0.3 um less air flow the HEPA
- LAL Test lab (Limulus amebocyte lysate)
- LPC Test Lab
- Incubator

❖ **Instrument used in quality control:**

1. pH meter :

- A pH meter is a scientific instruments in pharmaceutical industry that measures the hydrogen – ion activity in a solution, indicating the acidity or alkalinity and expressed as pH.

• Take to 25 gm substance of Ceftriaxone & Sulbactam sodium in 100 ml volume flask and final make up with water and check the pH (limit – 4.5 to 6.5)

Figure No: 3 pH Meter

2. Polarimetry :

- Used to determine product purity by measuring specific rotation and angle of rotation by passing polarized light through an optically active substance.

3. Bursting strength tester :

- It measure the bursting strength by applying hydraulic pressure , use to measure the resistance to rupture or burst material like paper, corrugated boxes , these test helpful to prove quality, performance and strength of the material to assure the toughness of material.

Figure no: 4 bursting strength tester

4. **Hot air oven :**
   - Dry the glass vials
5. **Melting point apparatus:**
   - It is used to determine the melting points with high accuracy and is supplies with a silicon oil bath with heating the bath.
6. **Vacuum oven :**
   - Used to clean volatile impunity.
7. **Muffle Furance :**
   - Used to heat material to extremely high temperature and the determine the percent of ash content in those material.

Figure no: 5 Muffle Furance

8. **Tap density tester :**
   - The tapped density is a very popular measure for powder characterization because of the both simplicity and rapidity of the measurement. The ability of a powder sample to pack under taps gives a measure of powder cohesiveness which can be linked to its flow ability.
9. **Centrifuge :**
   - Separate insoluble particles.
10. **Karl Fischer titrator :**
    - KF titrator used to determine the amount of water in sample.
11. **UV spectrometer :**
    - Ceftriaxone Sodium determination UV detection at 220 nm. Aqueous solution of Ceftriaxone Sodium showed absorbance maximum at 241 nm (range: 2 - 18 ug/ml).

❖ **Microbiology test in QC :**

1. Bacterial endotoxin Test (BET) :

- All injectable pharmaceutical products and implantable medical devices must be tested for the presence of endotoxins. If endotoxins are present, it can lead to a pyrogenic response (fever) or symptoms of septic shock.
- Check by Gel Clot Method :

➡ LAL regent is ➡ 1 hr at 37°C ➡ Invert it & check gel ➡ If Clot is

(Sample) add in equal Volume incubation clot formation is there or not endotoxin present

2. LPC (liquid Particle Counter) Test :

- Used to measure the size and volume of particles in a sample of ultrapure water.
- Limit of particle present : 10 µL- 600 micron

  20 µL- 6000 micron

3. Sterility Test :

- Sterility testing is define as testing which confirms that products are free from the presence of viable microorganism.
- The test sterility is based upon the principle that if microorganism are placed in a medium which provides nutritive materials and water and keep at a favourable temperature, the microorganism will grow and their presence can be indicated by turbidity in the originally clear medium.

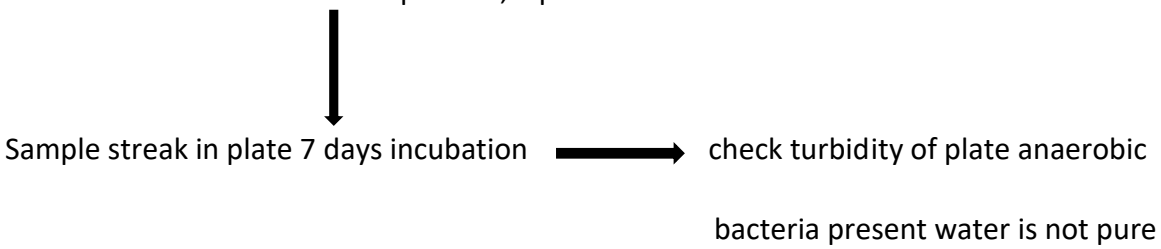
- Sterility test by Membrane Filtration method :

Product 20 vials + 100 ml of (Sample) Peptone Water —Dissolve→ Filter the dissolve Product

- Filter the dissolve product and 3 times rinse with peptone water (100 ml).

- Remove the Filter Membrane and membrane cut the help with sterile forceps and into half.
- Incubate 1 half in SCDM and other half in FTM broth.
- Incubate SCDM tube (20 – 25 °C) for 14 days.
- Incubate FTM tube (30 – 35 °C) for 14 days.
- Observed the tubes for turbidity every day till 14 days.

- Culture media :
  - Fluid thioglycolate medium (FTM) – For anaerobic bacteria
  - Soyabeen casein digest medium (SCDM) – Suitable for the culturing of both fungi & anaerobic bacteria.
- Turbidity check :
  - Turbidity is a measure of how cloudy water is.
  - SCDM & FTM 2 media present, 2 plate.



❖ **Microbial Limit Test :**

- Process of the analysis of the Pharmaceutical sample for microbial limit test including yeast & molds and pathogens like *E.coli*, *Salmonella*, *Pseudomonas aeruginosa.*

➢ **(Total Bacterial Count) :**

Preparation of Sample:

- 10 gm of substance is added to 100 ml of buffered sodium chloride peptone water [pH-7.0] and incubation at 30 – 35 °C for 30 minute.

Procedure:

- With the help of sterile pipette, 1.0 ml of sample is aseptically transfer to Petri dish.
- Now add 20 ml of liquefied, sterilized Soyabean Casein Digest Agar medium.
- Now the plate mixing and allow to solidify for about 1 hr.
- Then plate incubated in inverted position in incubator at 35 - 37°C for 5 days.
- After the completion of incubation period colonies are counted and multiply by dilution factor to get count per gm.

- **(Total Fungal Count) :**

- Same Procedure is used
- Instead of SCDM is used
- Plate incubated at 20 – 25°C for 3 days.
- After the completion of incubation period colonies are counted and multiply by dilution factor to get count per gm.

- **Test for Pathogen :**

- Preparation of Pathogenic Test :

10 gm Substance into 90 ml peptone water (Diluted Sample)

10 ml of diluted sample

↓

90 ml of tryptone broth

↓

Incubation 30 – 35 °C for 24 hr

- **Test of *E.coli.* :**

Shake TSB broth

↓ 1ml

100 ml of Macconkey broth

↓ 42 – 44°C

↓ 18 – 48 hrs.

Streak on plate of Macconkey agar and incubate plate at 30 – 35°C for 18 - 72 hr.

↓

Growth of pink, Non – mucoid colonies the presence E.coli.

- **Test for *Salmonella* sp. :**

Shake TSB

↓

0.1 ml

10 ml of RVsEB (Rappaport Vassiliadis *Salmonella* Enrichment Broth)

↓

Subculture on XLD agar (Xylose lysine deoxycholate agar) incubate 30 – 35°C for 24-48 hrs.

↓

Growth of red colonies with or without black presence of *Salmonella*.

- **Test for *Pseudomonas aeruginosa* :**

Shake TSB

↓ Streaking

Cetrimide agar in incubate at 30 – 35°C for 18 -72 hrs.

↓

Growth of green colour is presence of *Pseudomonas aeruginosa.*

❖ **Quality Assurance :**

- Providing technical information regarding the GMP treads to be incorporated in the protocols for the validation activities.
- Prepration and approval of validation master plan validation protocols, site master file, QA Manual, SOP, etc.
- QA : SOP , RA regulatory , Master file

1. QA – SOP
2. RA – (Regulatory) – Review
3. Design (art work) – carton , Sticker

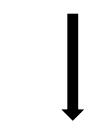
❖ <u>Department which include :</u>

- Maintenance of quality control of manufacturing procedure for each batch manufactured.
- Record of release, quarantine or rejection of components and finished products, containers, labels on quality control test result.
- Manufacturing process and process checks
- Production Record Review
- Stability testing and evaluation of shelf – life of products
- Line clearance before the start of any manufacturing process IPC person ensures proper line clearance.
- QA in-process team is Responsible for this activity and ensures compliance of all floor activities related to storage of raw material to final product dispatch.

❖ **Engineering :**

- **<u>Air Handling Unit :</u>**
- AHUs in cleanrooms performs the following basic function control airborne particle, dust and microorganism through air filtration Using efficiency particulate air (HEPA) filters .
- Maintain room pressure areas that must remain cleaner than surrounding areas must be kept under a positive.
- Main purpose of the AHU is to ensure comfort to the staff and employee.
- HEPA (High efficiency particulate air) filters will be acceptable only if they are capable of removing all particulate matter 0.3 micron in size with an efficiency 99.97 %.
- These filters can remove microscopic substance from the air like mold, dust and pet dender.
- **<u>HVAC (Heating ventilation and air conditioning) :</u>**
- They control the manufacturing environmental, which can impact the strength, identify, safety, purity, and quality of product.
- Main purposes of a heating, ventilation and air conditioning system are to help maintain good indoor air quality through adequate ventilation with filtration and provide thermal comfort.
- **<u>Pour Steam Generator :</u>**
- Pure steam generator as per CGMP requirement it is recommended to use pure steam in place or filtered plant steam. This steam is used for all in situ. Like sterilization of vessels, pipping distribution system, autoclaves and for humidification of sterile rooms.
- Clean steam is the steam generated from treated water, free from volatile additives, such as amines, hydrazine.
- **<u>Water purification system :</u>**

Raw water



Storage tank

(Sodium Hypochlorite is added for chlorination)

Pressure sand filter

Filter water

Micron cartridge filter (10 Micron)

(SMBS antiscalant)

Reverse Osmosis system

(Permeated water and rejected water)

EDI (Electrode-ionization)

RO system permeated water

Mix Bed Unit

(Demineralized water)

Carbon filtration

Filters Units (1 Micron)

UV system (254 nm)

Purified water

Figure no: 6 Water System

❖ **water system :**

➢ Raw water :

- Bore well supplies adequate water which store tank of 55k liter capacity and 16k litre.

➢ CSRO (Chemical Sanitizable RO) :

- CSRO from the 5k litre raw water store tank, water supplies to MGF, membrane and softener for primary treatment to remove dissolved organic & inorganic impurities in RO and store in 2k litre HDPE storage tank.

➢ Purified water :

- RO water after chlorination & filtrations use as feed water for purified water system. The system involves passing of the feed water through activated charcoal filters followed by cation exchanger, weak base anion exchanger, storage base anion, UV purifier mix bed, finally UV purifier allowed by filtration through 25 µ filters in sequener.

➢ Specification water :

- Purified water complies with the specification as per IP/BP with regards to chemical and microbiological testing.

➢ Sampling point :

- Sample of water for analysis is withdraw from loop and 27 sample points in water system.

➢ Sanitations :

- Wall defined program exists for sanitation of purified water system. Sanitations of purified water system is done at temperature more than 80°C to 85°C at a frequency of once in 30 days ± 2 days.

❖ **Reference :**

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