# WEEK-5

# Pharmaceutical Water

# Water is an important ingredient for pharmaceutical products.

- **It is the most common vehicle for drugs,**
- **and first choice for solving materials.**

**Besides,**

- **Water is used in every step of pharmaceutical production**
- **It is physiologically inert**

Water can be used as,

- solvent and vehicle in preparing pharmaceutical dosage forms
- for synthesize drugs and excipients
- in different steps of production such as cleaning.

In all these steps type/quality of water needed is different. For example,

- for preparing an injectable dosage form, water must be sterile and injectable
- if the formulation is orally given purified water can be used

# Water types used in different areas in industry

## Applications at a glance

### Analytical and General Applications

| Technique | Sensitivity | Conductivity µS/cm | TOC ppb | Filter µm | Bacteria CFU/ml | Endotoxin IU/ml | Grade of Pure Water |
|---|---|---|---|---|---|---|---|
| Buffer & media preparation | General | <1 | <500 | NA | <100 | NA | Purified Water |
| Feed to stills | Low | <1 | <500 | NA | <100 | NA | Purified Water |
| Feed to Ultra-pure water systems | General | <1 | <50 | NA | <1 | NA | WFI HPW |
| Glassware washing | General | <1 | <50 | <0.2 | <10 | NA | Purified Water |
| | High | <0.05 | <10 | <0.2 | <1 | NA | WFI HPW |
| Cleaning In Place | General | <1 | <50 | NA | <100 | NA | Purified Water |
| | High | <0.05 | <10 | NA | <0.1 | <0.25 | WFI HPW |
| Microbiological Analysis | General | <1 | <50 | <0.2 | <100 | NA | Purified Water |
| Qualitative Analyses | General | <1 | <50 | <0.2 | <1 | NA | WFI HPW |
| Steam generation | General | <1 | <500 | NA | <100 | NA | Purified Water |
| Water analysis | General | <0.2 | <50 | <0.2 | <1 | NA | Purified Water |
| | High | <0.05 | <10 | <0.2 | <0.1 | <0.25 | WFI HPW |

Critical impurities - NA Not applicable

**Water for pharmaceutical purposes must be prepared from**

**potable (drinking) water**

**by using suitable methods.**

Resources for potable water can be

- **Groundwater**
- **Surface water**

Surface water or ground water can contain components of earth, rock and air.

- Solubilized minerals and salts
- Suspended and colloidal particles
- Dissolved gases
- Living and dead organisms and their metabolic products (E.Coli)
- Organic substances (humic acid, tannin, lignin)

Also surface water can exhibit variations in quality according to the changes in seasons, location, pesticides, fertilizers and animal excretions. Especially total organic carbon (TOC) amount is affected by seasonal temperature.

## Potable water:

- This is the water suitable for drinking.
- Characteristics of potable water is controlled by EPA (Environmental Protection Agency)
- EPA concerns about microbiological purity rather than mineral contents.

- E. Coli is the most important bacterial content as it is the indicator of coliform microorganisms which comes from fecal contamination in water.
- Potable water must not involve E. Coli more than 5% of the total monthly samples.
- Total aerobic microbial count for potable water must be under 500 cfu/mL.

cfu: colony forming unit

- Potable water may be derived from a variety of sources and is the feed water for Purified water.
- It can also be used in early stages of chemical synthesis and cleaning of equipment.
- However according to USP it must not be used for prepare reagents in analysis.

**Water for pharmaceutical purpose requires unchangeable properties and high quality. Thus, potable water must be clarified before use.**

- Settling
- Filtration
- Ion Exchange

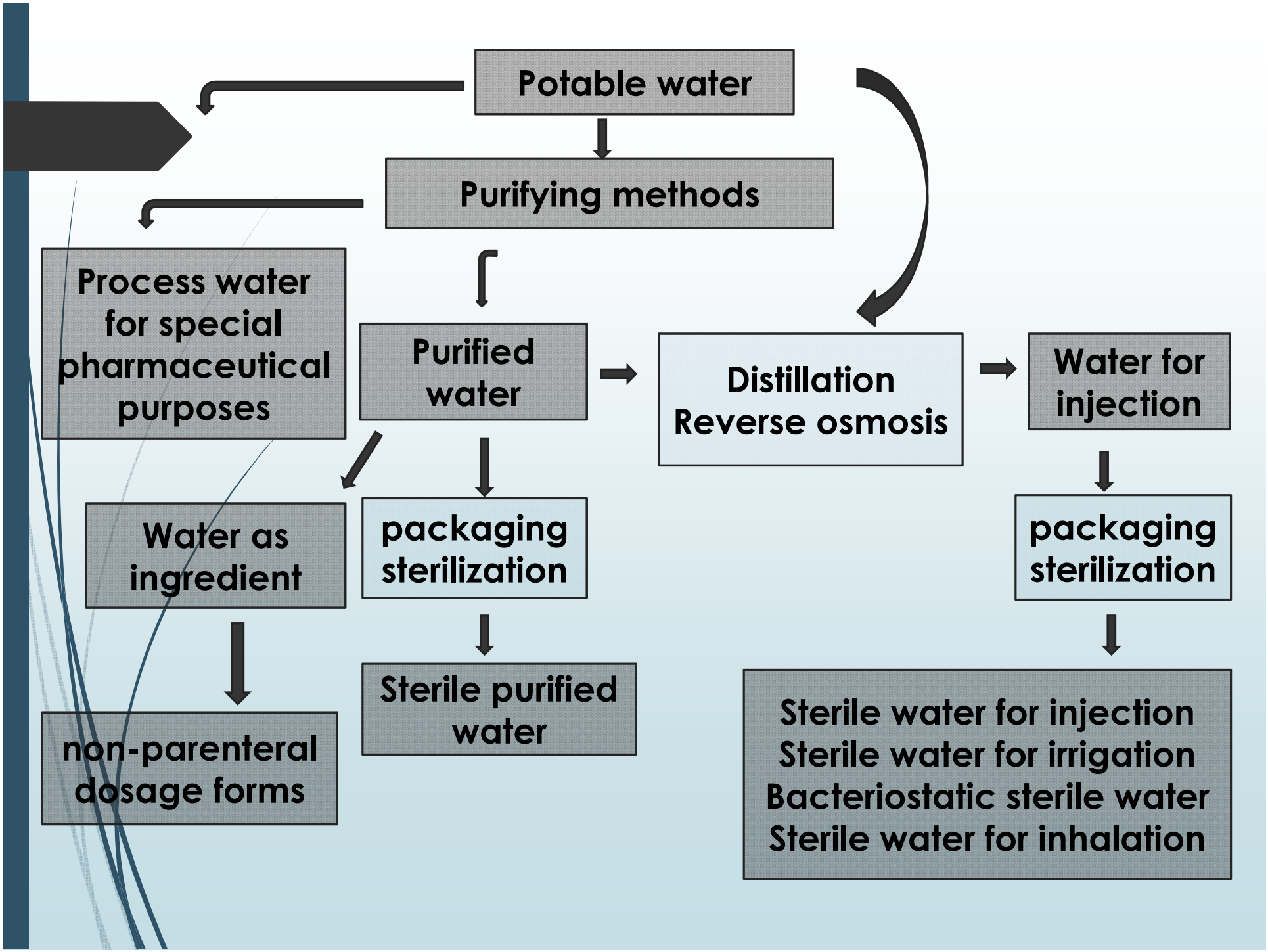
→ removal of insoluble material

- Aeration

→ palatability improvement

- Chlorination
- Activated charcoal

→ removing pathogenic microorganisms


Potable water
Purifying methods
Process water for special pharmaceutical purposes
Purified water
Distillation
Reverse osmosis
Water for injection
Water as ingredient
packaging sterilization
packaging sterilization
non-parenteral dosage forms
Sterile purified water
Sterile water for injection
Sterile water for irrigation
Bacteriostatic sterile water
Sterile water for inhalation

## American Pharmacopoeia (USP)

- Purified water
- Sterile purified water
- Water for injection
- Sterile water for injection
- Bacteriostatic water for injection
- Sterile water for irrigation
- Sterile water for inhalation

## European Pharmacopoeia (EP)

- **Water, Purified**
  - ***a.*** **Purified water in bulk**
  - ***b.*** **Purified water in containers**
- **Water , highly purified**
- **Water for injection**
  - ***a.*** **Water for injection in bulk**
  - ***b.*** **Sterilized water for injection**

## Purified water (USP)

- Water obtained by distillation, ion-exchange, reverse osmosis, filtration or other suitable process.
- It is prepared from drinking water (which must comply with the EPA regulations).

Purified water is

- ingredient of pharmaceutical formulations,
- Used for cleaning of equipment,
- Used for preparing some bulk pharmaceutical chemicals,
- Used in tests and assays
- is the source of sterile purified water for non-parenteral dosage forms

- Purified water must contain less than 100 cfu/mL aerobic microorganism

# Purified water (EP)

- ✓ In EP purified water is divided into 2 subgroups;
  - ➨**Purified water in bulk**
  - ➨**Purified water in containers**

*Purified water in bulk*

✓**Total viable aerobic microorganism limit** is important.
✓**TOC value** must be less than 0,5 mg/L.
✓**Conductivity** must be less than 4.3 µS/cm (20°C)

*Purified water in containers*

✓Packaged after purification, do not consist any additive.
✓Must be kept away from microbiologic contamination .
✓Sutable for preparing dialysis solutions.

**there is no need for these waters to be sterile and non-pyrogenic**