

Water for Hemodialysis

SYSTEM CONSIDERATIONS



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PATIENT CONDITIONS: GENERAL SIGNS, SYMPTOMS, AND CAUSES

Symptom

Possible Cause

Anemia

Aluminum, Copper, Chloramine, Zinc

Bone Disease

Aluminum, Fluoride

Hemolysis

Chloramine, Nitrates, Copper

Hypertension

Calcium, Sodium

Hypotension

Bacteria, Endotoxin, Nitrates

Metabolic acidosis

Low pH, Sulfates

Muscle weakness

Calcium, Magnesium

Nausea/Vomiting

Bacteria, Calcium, Copper, Endotoxin, Low pH, Magnesium, Nitrates, Sulfates, Zinc

Neurological Deterioration

Aluminum

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SYSTEM DESIGN

- **The source water is analyzed to determine the highest possible levels of contaminants. Factors considered may include:**
 - **Bacterial load**
 - **Temperature fluctuations**
 - **In-organic contaminant level testing**
 - **pH**
- **Only after the water analysis is complete and all factors are considered, is the necessary equipment selected.**

WATER TREATMENT STAGES

Pretreatment



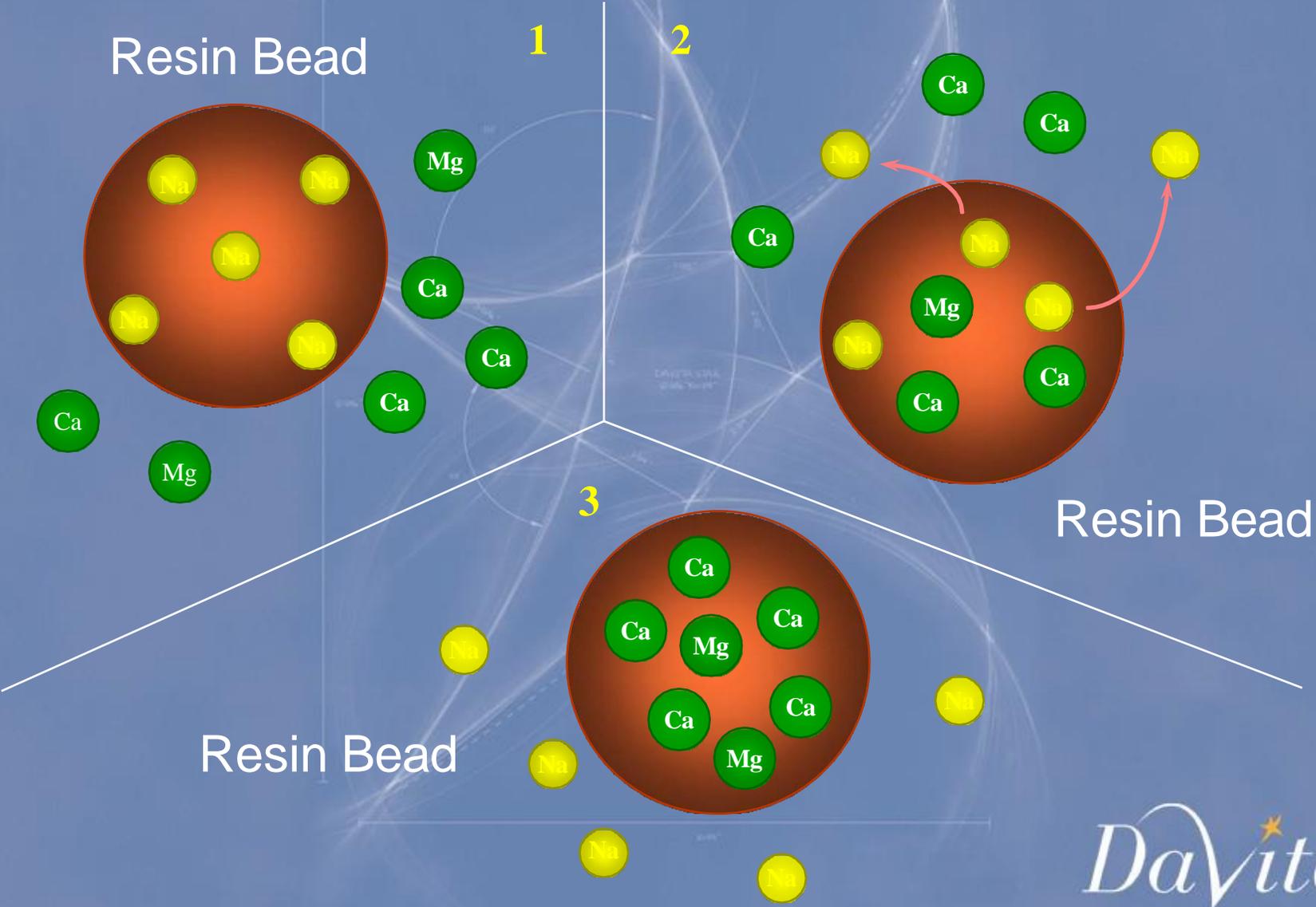
Purification &
Distribution

WATER SOFTENER

Ion exchange process:

- Removes **calcium & magnesium** "hardness" ions
- Adds "soft" **sodium**

WATER SOFTENER - PRINCIPLE OF ION EXCHANGE



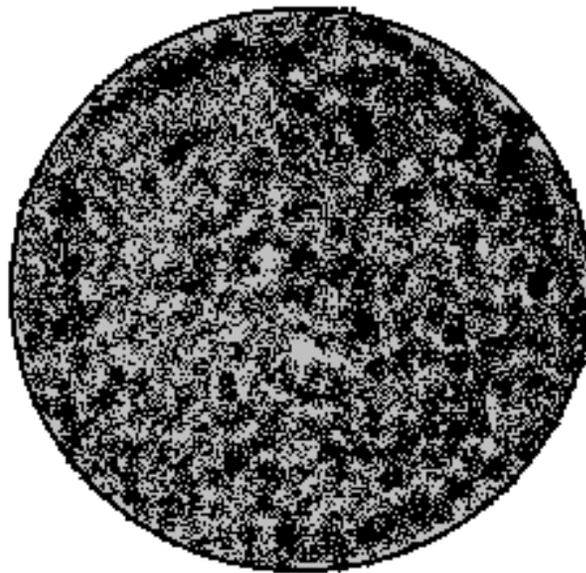
WATER SOFTENER



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CARBON ADSORPTION

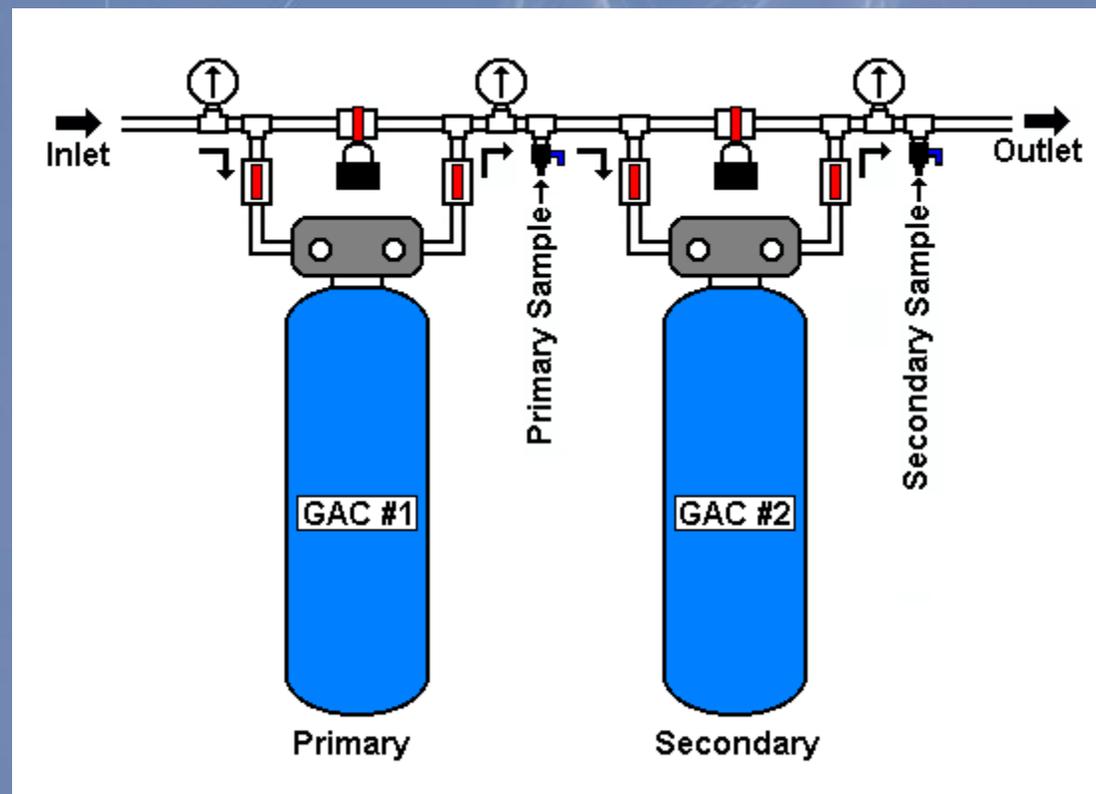
ACTIVATED CARBON GRANULE



ADSORPTION

- ← FREE CHLORINE
- ← CHLORAMINE
- ← ORGANICS

PAIRED BACKWASHABLE CARBON FILTERS



WATER TREATMENT STAGES

Pretreatment



**Purification &
Distribution**

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PURIFICATION COMPONENTS

- ❑ Reverse Osmosis (RO)
- ❑ Deionization (DI) + Ultrafiltration (UF)

REVERSE OSMOSIS

- ❑ Pump & membrane system *reverses* osmotic flow to produce purified water
- ❑ Removes **chemicals, bacteria & endotoxin**

RO SYSTEM



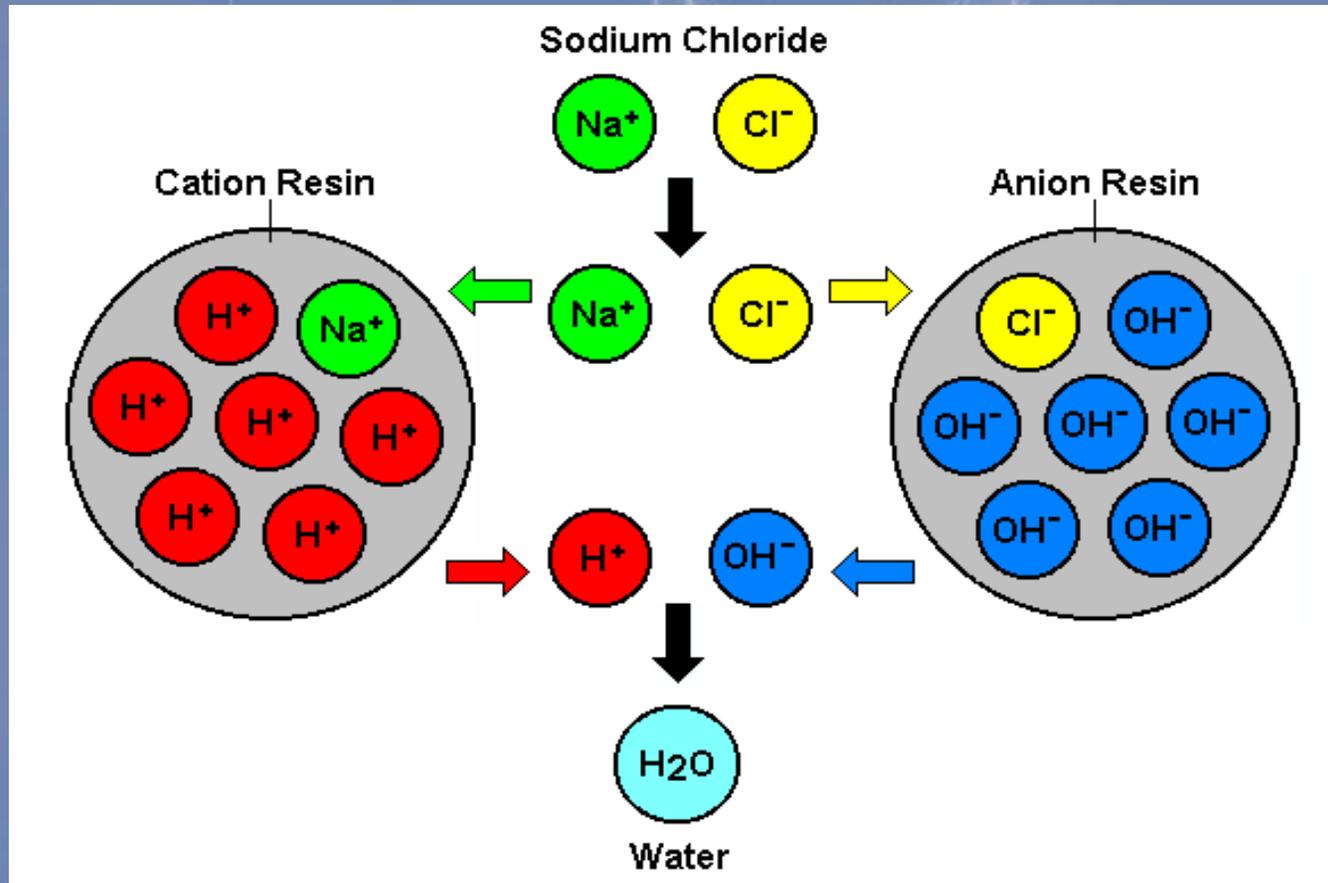
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DEIONIZATION

- ❑ Ion exchange process removes both **cations & anions**
- ❑ DANGEROUS when exhausted
- ❑ Often increase bacterial & endotoxin

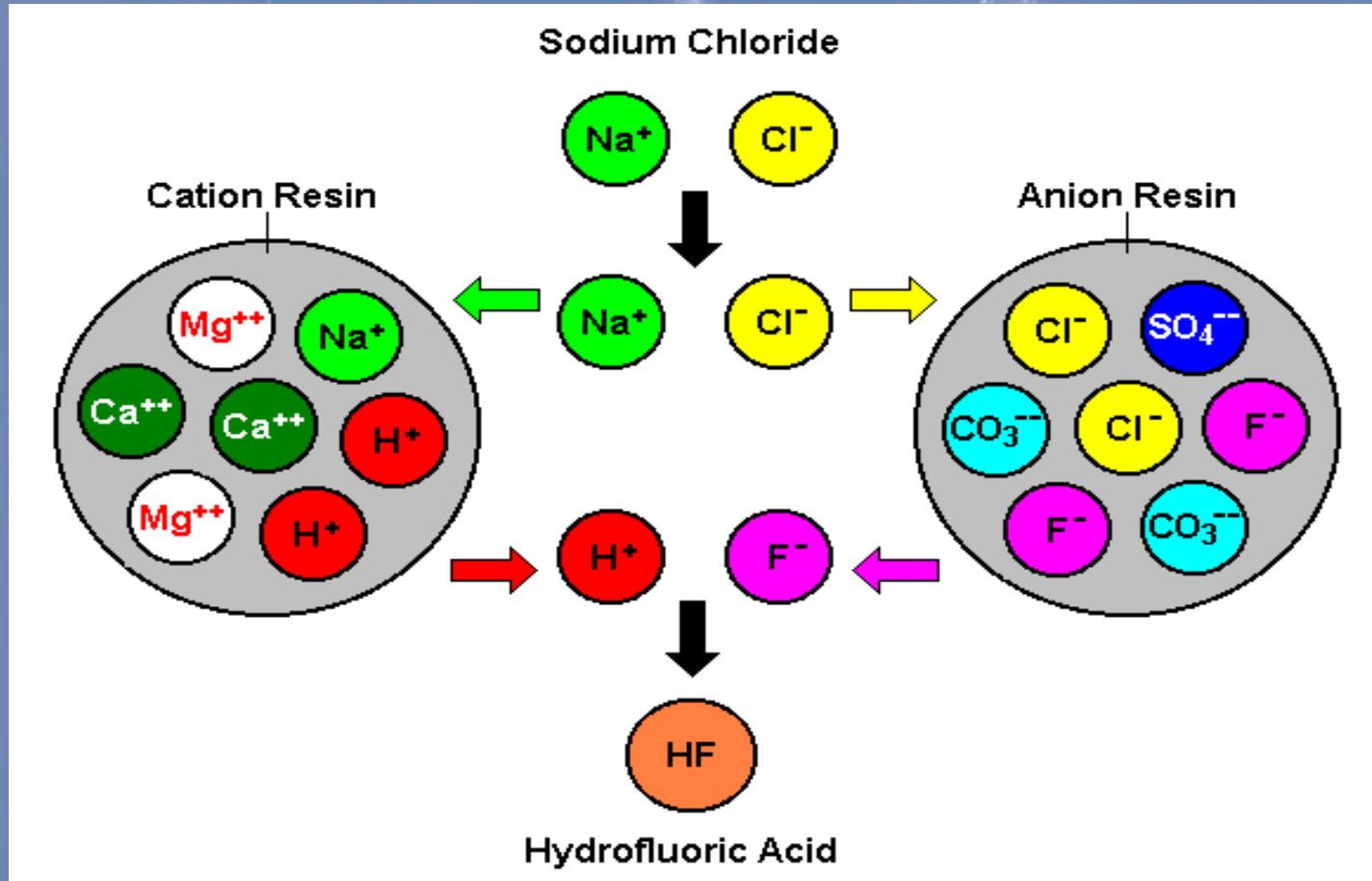
DEIONIZATION

ION EXCHANGE PROCESS



DANGEROUS

DEIONIZER EXHAUSTION



DEIONIZATION (DI) SYSTEM



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ULTRAFILTRATION

- ❑ Filtration process removes **bacteria & endotoxin**
- ❑ Required downstream of **Ultraviolet Irradiators (UV)**

ENDOTOXIN FILTER



WATER STORAGE TANK AND RECIRCULATION PUMP



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