

Pharmaceutical Applications

for

Ion Exchange Resins

Puro<sup>l</sup>ite Ion Exchange Resins

# Pharmaceutical Applications

for ion exchange resins

- ◆ Drug Purification
- ◆ Tablet Disintegrant
- ◆ Slow Drug Release
- ◆ As the Drug Substance

# Pharmaceutical Applications

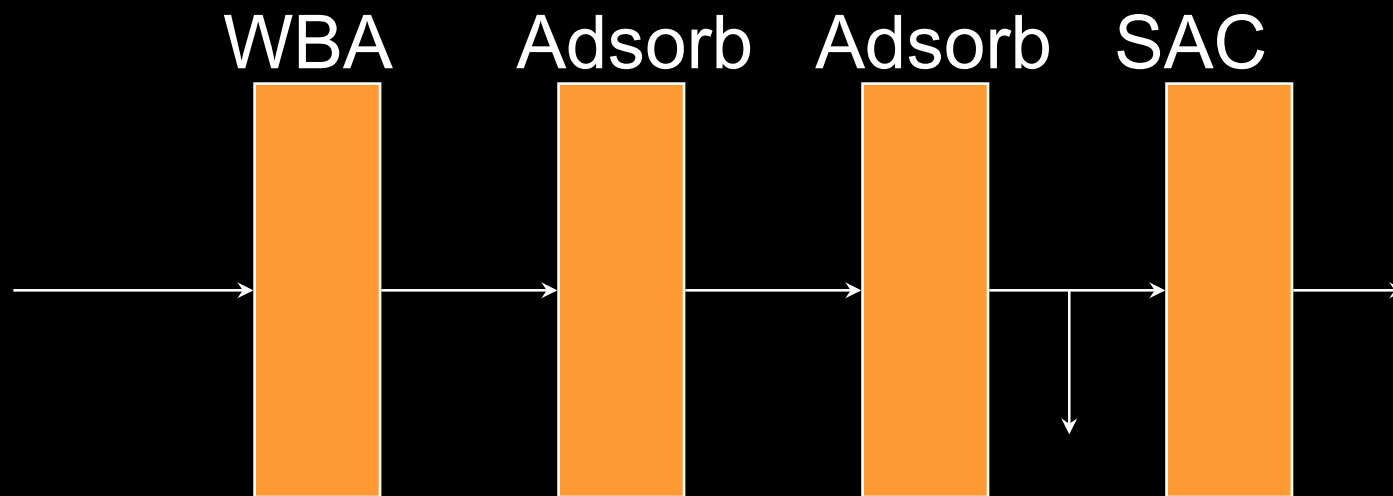
for ion exchange resins

- ◆ Drug Purification

# Purification of Cephalosporin-C

- ◆ Weak Base Anion Resin:
  - removing residual anions
  - partial decolorization
- ◆ Adsorbent resin 1 :
  - completion of decolorization
- ◆ Adsorbent resin 2:
  - adsorbs Cephalosporin-C
- ◆ Cephalosporin-C eluted using IPA
  
- ◆ Strong Acid Cation :
  - converts Cephalosporin-C to Na<sup>+</sup> form

# Purification of Cephalosporin-C





## Tablet Disintegrant

# Tablet Disintegrant

Weak Acid Cation Resin

- Carboxylic type

Moisture Content:

- 50% in H<sup>+</sup> form

- 75% in Na<sup>+</sup> or K<sup>+</sup> form

# Tablet Disintegrant

Typical Use:

- for tablets of Phenobarbitone

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US Pharmacopeia name for the resin:

- “Polacrillin Potassium”

# Tablet Disintegrant

Resin is 75% - 90% converted  
to  $K^+$  form

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Purified beads ground to  
<100 microns powder

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A few percent of resin powder is  
compressed into tablet

# Tablet Disintegrant

When tablet contacts water:

- ◆ resin particles rapidly hydrate
- ◆ resin expands in volume
- ◆ tablet disintegrates

# Pharmaceutical Applications

for ion exchange resins

- ◆ Slow Drug Release

# Slow Release Drug

- Process of Ion Exchange is not instantaneous
- Resin allows slow release of drug into gastric system
- Resin usually in fine powder form is loaded with drug.

# Slow Release Drug

- Drug is consumed orally by patient
- In the stomach, the drug is slowly released when it contacts the intestinal fluids

# Pharmaceutical Applications

for ion exchange resins

- ◆ As the Drug Substance

# As the Drug Substance

- Resin is **insoluble**
- Will pass through human digestive system **without being absorbed**

# As the Drug Substance

- Will be **expelled** through normal waste functions
- Resin has **no side effects** on human body (non-systemic)

# As the Drug Substance

- Two Major Applications as:-

(1) - “Cholestyramine”

(2) - “Sodium Polystyrene  
Sulphonate”

# Cholestyramine

- Used to **reduce cholesterol**
- Cholesterol is essential to human life
- In the body, cholesterol is oxidized to bile acids
- bile acids then converted to salts of glycine and taurine conjugates in the liver

# Cholestyramine

- Salts of glycine and taurine emulsify ingested fats
- During the adsorption phase of digestion, 90% of bile salts are re-adsorbed
- Thus, **bile salts produced from cholesterol pass to the intestine and are then returned to the liver**

# Cholestyramine

- There are two types of cholesterol:
  - “Good” HDL Cholesterol
  - “Bad” LDL Cholesterol

# Cholestyramine

- The liver produces :

Very Low Density Lipoprotein

( **VLDL** )

- **VLDL** is secreted into the blood

# Cholestyramine

- Some **VLDL** combines with **HDL** to produce **LDL**



**LDL cholesterol** causes Cholesteryl ester to clog artery walls resulting in:-

- restriction of blood flow
- potential heart attack

# Cholestyramine

“Cholestyramine” is really a

Strong Base Anion Type I  
Resin in Chloride form

copolymer matrix:

Styrene-DivinylBenzene

functional group:

quaternary ammonium

# Cholestyramine

“Cholestyramine” is identical in chemical nature to  
SBA Type I resins

Except moisture content is about 70%

# Cholestyramine

## Resin Preparation:

- **thoroughly cleaned**
- **dried**
- **ground to powder <150 microns**
- **powder is flavored**
- **consumed while dispersed in water or fruit juice**

# Cholestyramine

## Function of “Cholestyramine” resin

- bile acid reduction:-
  - resin releases chloride ions which are exchanged for the anions of the bile acid salts
  - bile acid salts bound to the anion resin cannot be adsorbed by the body
  - the resin with adsorbed salts is excreted unchanged

# Sodium Polystyrene Sulphonate

Strong Acid Cation Resin in Sodium form

Identical in composition to resins  
used is water softening

# Sodium Polystyrene Sulphonate

Normal serum concentration for :

Potassium - approx. 5 m mol /liter

Sodium - approx. 140 m mol/liter

Calcium - approx. 2.5 m mol/liter

Potassium is excreted via the kidneys

High Potassium levels arise when urine output reduces to < 250 ml /day

# Sodium Polystyrene Sulphonate

Product is supplied in 2 forms:

- Sodium form
- Calcium form

Major Manufacturer: Sanofi-Winthrop

e.g. Resonium A (Na<sup>+</sup> form)

Calcium Resonium (Ca<sup>++</sup> form)

# Sodium Polystyrene Sulphonate

Product will steadily remove  $K^+$  as it progresses through intestinal tract



Resin is excreted with the faeces.

# Sodium Polystyrene Sulphonate

## Preparation:

- Purified
- Dried
- Ground to Powder < 150 microns

## Dosage:

15 grams flavored

3 - 4 times daily orally (in water)

# Purolite Brand Products for Pharmaceutical Applications

C-115 KMR (Polacrillin Potassium)

A-430 MR (Cholestyramine)

Polystyrene Sulphonate:

C-100 Na MR (Sodium form)

C-100 Ca MR (Calcium form)

# Pharmaceutical Applications for Ion Exchange Resins

END