

# Decolorization by IER

Mitsubishi Chemical Co.  
Separation Material Department

# What are color compounds?

## □ Major Color Compounds are Anionic (R-COO<sup>-</sup> H<sup>+</sup>)

Origin of Component : degraded plant tissue

Chemical Structure : Polyphenol structure with COOH residue

Molecular Weight : large >10,000 ex humic acid

How to remove : Low crosslinked strong base anion exchange resin (PA308)  
or high porous type (HPA25)

## □ Minor Color Compounds are Cationic (R-NH<sub>3</sub><sup>+</sup> )

Origin of Component : Protein degradation

Chemical Structure : Organic compound with amine residue.

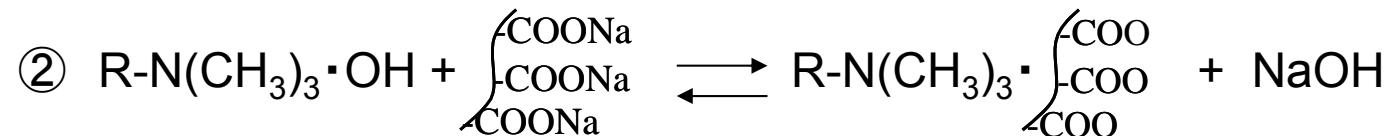
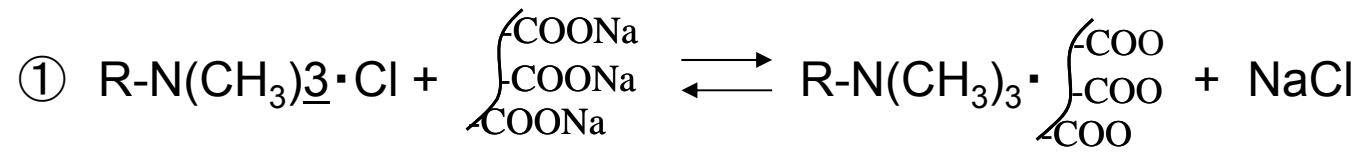
Some have COOH group (ie. degraded protein),  
so it is both cationic and anionic in nature; depending on pH.

Molecular weight : large (true MW unknown)

How to remove : low to medium crosslinked strong acid cation exchange resin  
either porous (PK208,212,216), or highly porous (RCP160M)

# Principle of Decolorization I

**Anion pigments are removed with anion exchange resins.**



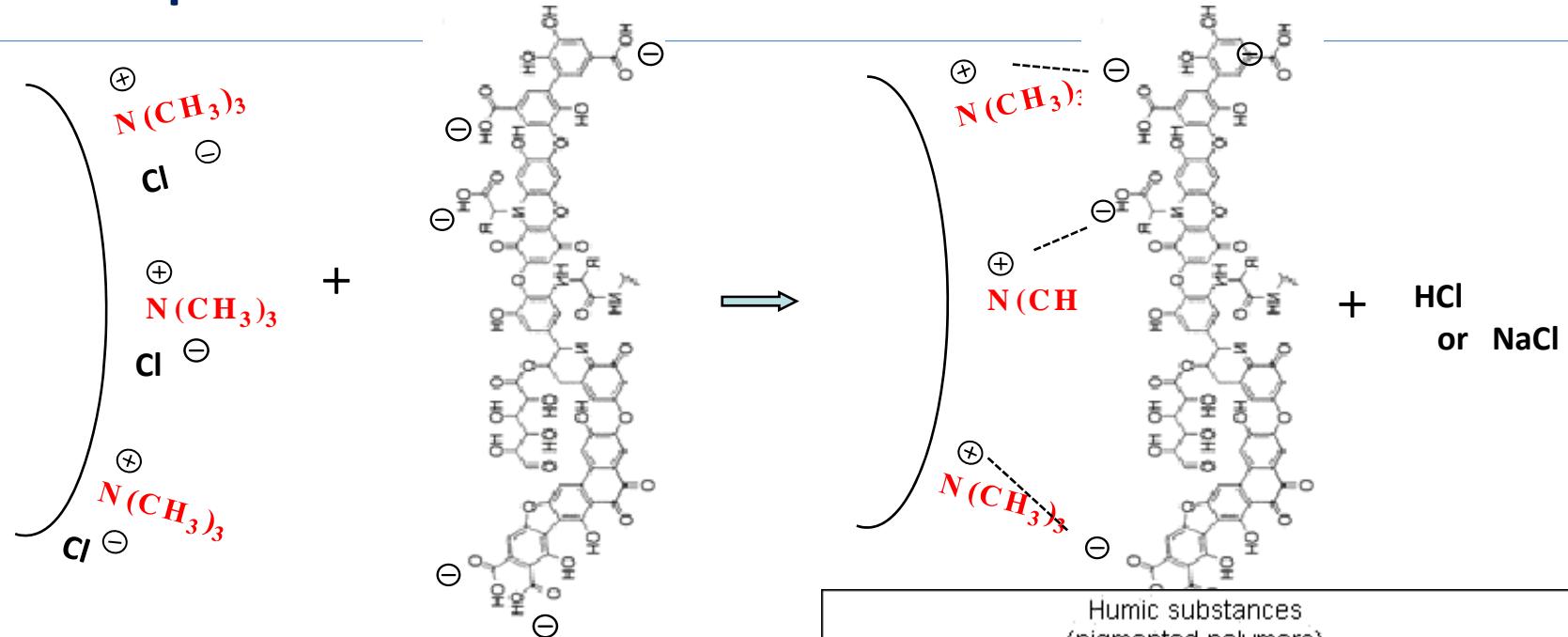
**① R-Cl decolorization**

Strongly Basic Anion ER (Type I) : PA308L  
 (Low Crosslinkage. Cl form)

**② R-OH decolorization (Reverse demineralization)**

▪ Strongly Basic Anion ER: PA308L

# Example of reaction



Anion exchange resin

Coloring  
compounds (ex  
humic acids)

Humic substances (pigmented polymers)			
Fulvic acid	Humic acid	Humin	
Light yellow	Yellow brown	Dark brown	Grey black
increase in intensity of colour			→
increase in degree of polymerization			→
2 000	increase in molecular weight		→ 300 000 ?
45%	increase in carbon content		→ 62%
48%	decrease in oxygen content		→ 30%
1 400	decrease in exchange acidity		→ 500
	decrease in degree of solubility		→

Chemical properties of humic substances. (Stevenson 1982)

# Principle of decolorization II

- MW of pigments are large

→ Ion exchange occurs on the surface of resins

→ Large pore resin shows high capacity.

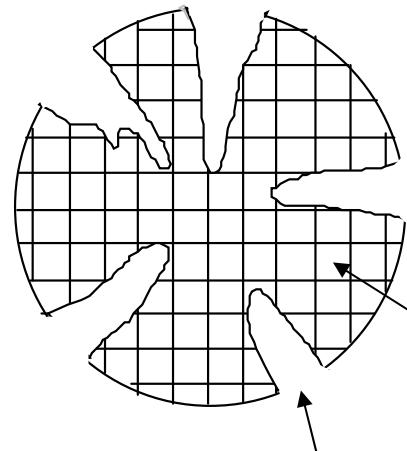
Gel type : SA11AL

Porous type : PA308, PA312

High porous type : HPA25, WA30

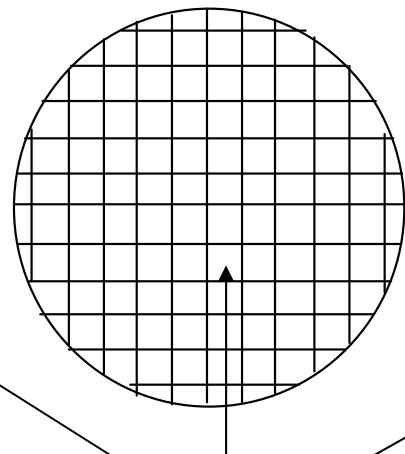
# Physical Structure of I.E.R

Porous Type  
(PA308L)



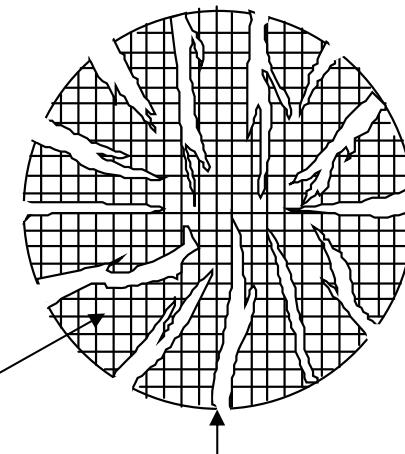
Macro pore  
(10 - 10,000 Å)

Gel Type  
(SA11AL)



Micro pore  
(0 - 300 Å)

High Porous (MR)



Macro pore  
(10 - 1,000 Å)

Cross Linkage (DVB %)

Porous, Gel: 2 - 16%

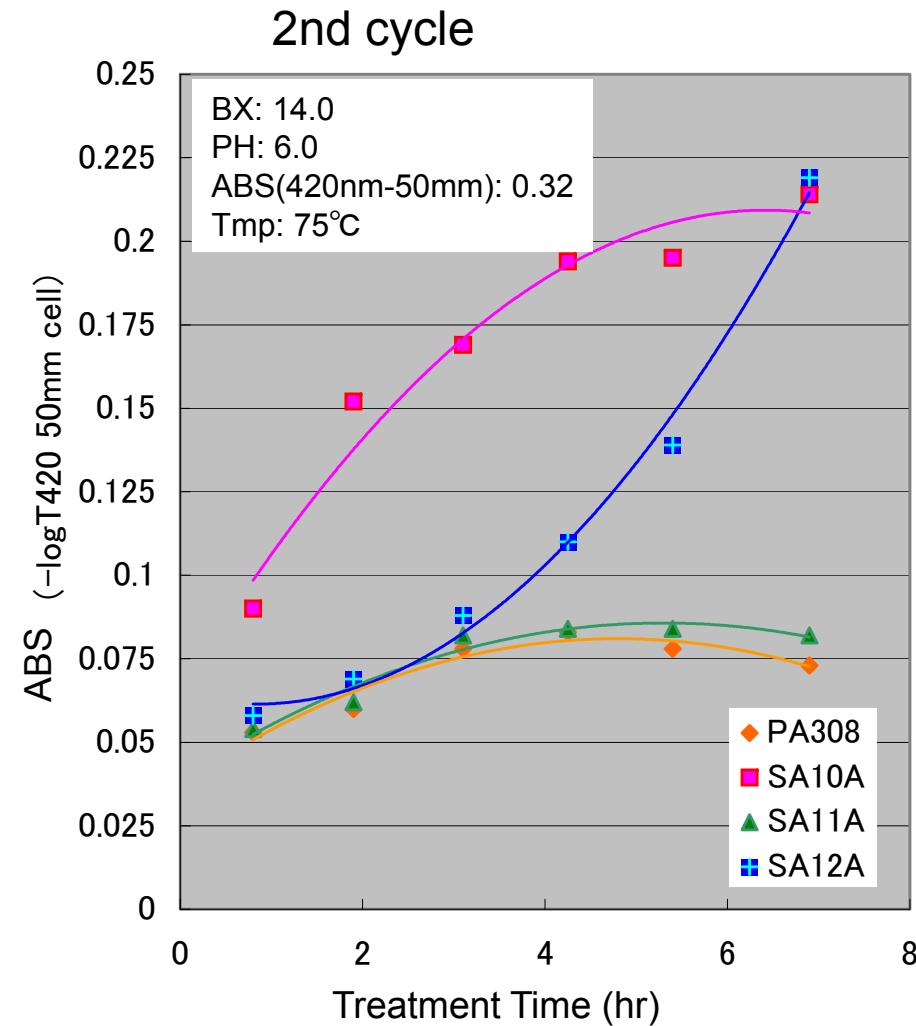
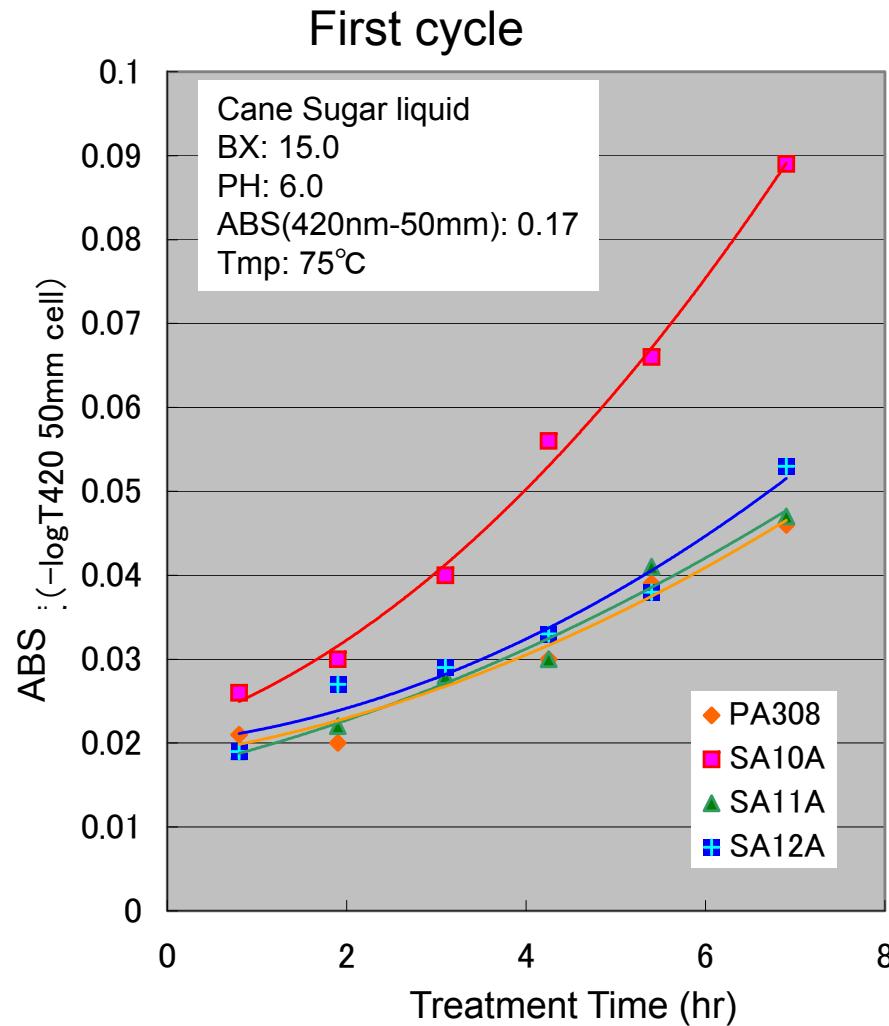
High por.: >15%

Reaction Rate

Porous > Gel > High Porous

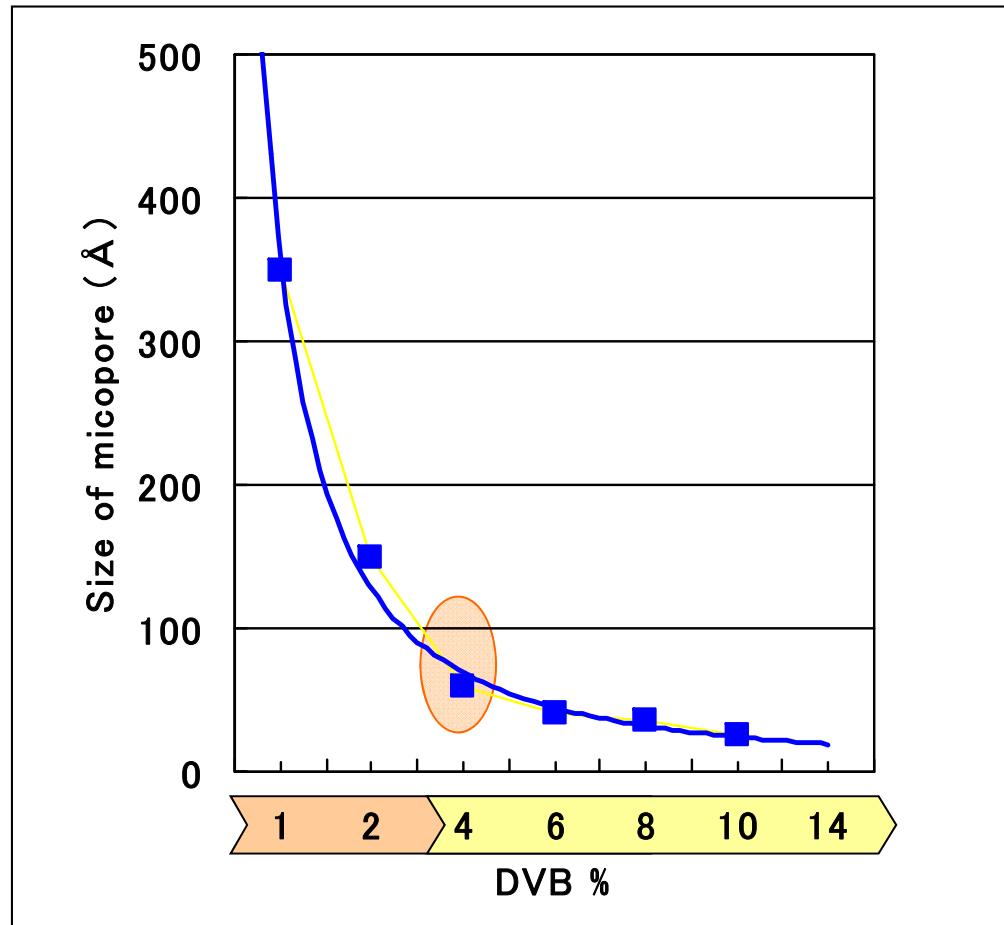
6

# Relation between Crosslinkage & Decolorization Efficiency



DVB %: SA10A > SA12A > PA308 ≈ SA11A

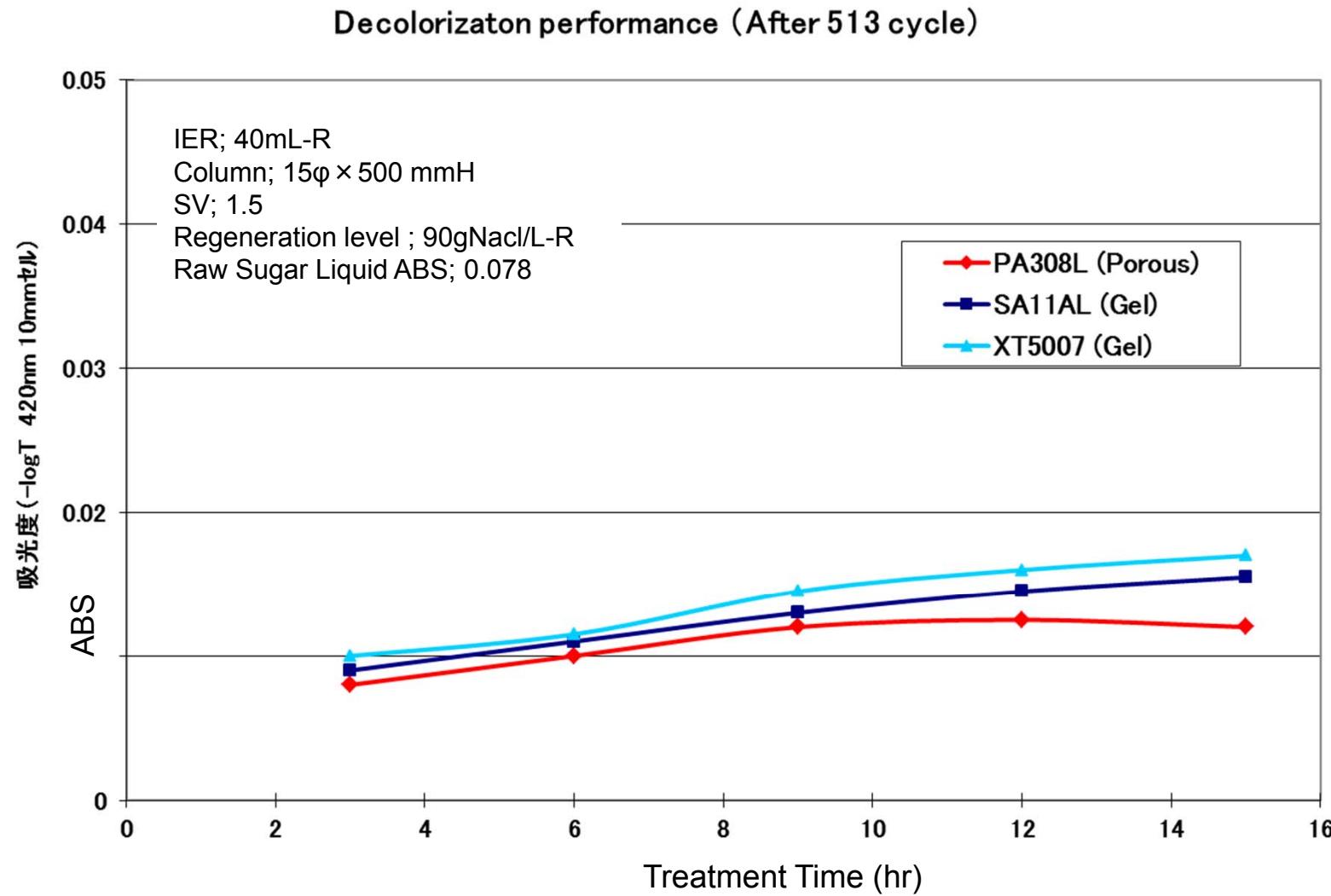
# Relationship of Pore Size and DVB%



**Lower DVB % Anion IER are good for decolorization**

8

# Comparison of Decolorization



XT5007: Amberlite

9