Separation of Weak and Strong Acids

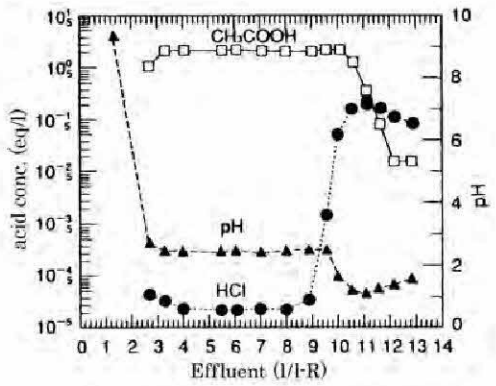
(Extracted from the Diaion Manuals pages 246 to 248)

11. Separation of Strong and Weak acids

Strong acids and weak acids can be separated by advance chromatographic separation method based on the difference between their selectivity toward AERs. Though both SBAERs and WBAERs can be used, WBAERs are common in the field because of their large exchange capacity and of the easiness to be regenerated; the IERs should be regenerated with NaOH solutions since they are saturated with acids of high selectivity.

The IERs used for this separation should have good strength against the crush caused by swelling and shrinkage of resins since they are loaded with highly concentrated acids in a short time.

Fig.VII-11-1[60] illustrates the removal of HCl in acetic acid the objective of which is to eliminate chlorides that could erode the equipments during concentration of solutions: The raw solution is a) treated with free-base form WA21J, b) drained out at the point where HCl begins to leak which detected by a continuous monitoring of electrical conductivity, c) regenerated with NaOH solutions and NaCl formed is discarded.



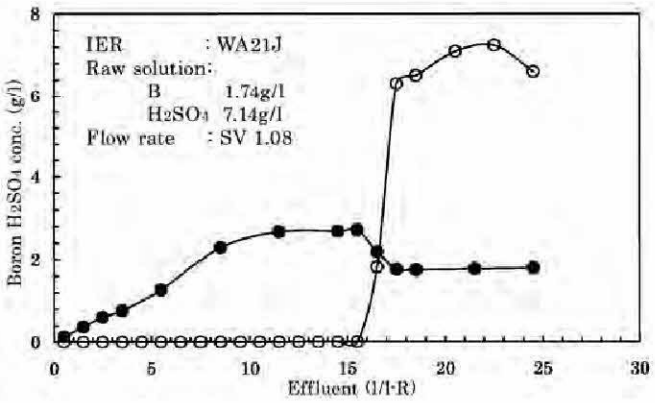
[[Fig.VII-11-1] Removal of HCl in acetic acid with WBAER

Compositions of Raw solution
pH: 0.68
CH_3COOH: 1.1241eq/L
HCl: 0.2417eq/L
Feed rate: SV $1h^{-1}$
Regeneration level: NaOH 200g/L·R

Though acetic acid and HCl are both adsorbed by IERs in the beginning of these procedures, acetic acid of weak selectivity elute first at the concentration as the sum of both acids. The electrical conductivity rises as soon as HCl-leakage starts. Draining soon after the conductivity rises, the IERs are then regenerated with NaOH solution into free-base form and reused at the next treatment.

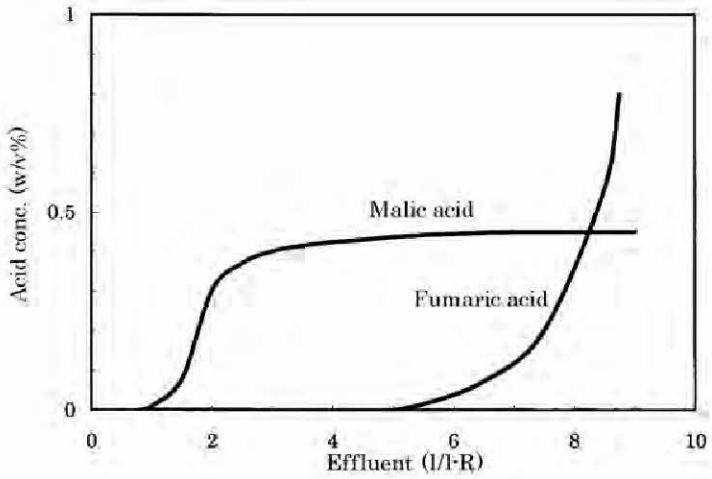
At clause 1 of Chapter VI concerning boron waste water treatments, it is already explained that the boron adsorbed by boric acid selective adsorption resins elute with mineral acid such as H_2SO_4. The before-mentioned method can be applied to collect boron from these elution waste waters. Fig.VII-11-2 [61] illustrates removal of H_2SO_4 from boron elution waste water with WBAER, WA21J.

The proceedings are all about separation of strong acids and weak acids. Organic acids can be, in some cases, separated from each other. DL-Malic acid, a sour agent in soft drinks, is manufactured in the following procedures: a) maleic acid and fumaric acid are made from benzene by catalytic oxidation, b) hydrolysis of both acids at 160 ~ 200 °C under pressures to form malic acid and fumaric acid, c) separation of malic and fumaric acids and d) purification by crystallization. The acid separation can be carried out with SBAER, SA20A. Purification of crude malic acid with SA20A is demonstrated in Fig.VII-11-3.



[Fig.VII-11-2] Boron recovery from Boron elution waste water

●B ○H_2SO_4



[Fig.VII-11-3] Purification of crude Malic acid with SA20A

IER: SA20A
Raw solution: Malic acid 1.38g/L
Fumaric acid 0.38g/L
Flow rate: SV 0.96
Temp.: 50℃