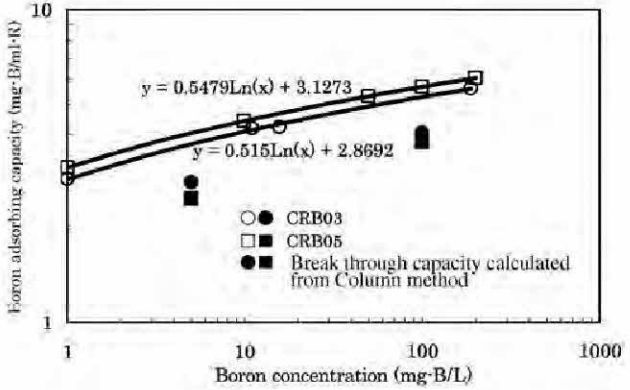
Boron Removal

(Extracted from the Diaion Manuals pages 207 to 208)

Chapter VI Waste Water Treatments and Valuables Recovery

1. Treatments Boron waste waters

Boron waste waters are generally discharged from the industries or factories such as nickel plating, aluminum surface finishing, glass manufacturing, glaze manufacturing, incineration plants and thermal power plants. Though Boron is one of the essential elements for plants, it is considered to inhibit the plant growth and to cause neurological disorders of animals when its concentration exceeds some level. Regarding its effect to human health, it is pointed out that continuous intake of small amount of Boron possibly causes reducing reproductive function and other health problems, although the details are not still clear. Thus, Environmental quality standard value of below 1 mg/L was notified in October 1999, and its effluent standard was also promulgated on June 2001 and enforced as of July 1, 2001.



[Fig.VI-1-1] Equilibrium adsorption of Boron with CRB and BTC
Resin: 50mL (column: 17mmΦ x 500 mmL)
Raw water: H_3BO_3 100mg/L or 5mg/L
NaCl 30mg/L
pH = 7
Flow rate: SV 5
BTP: 1mg/L

Boron in such waste waters can be removed with boric acid selective adsorption resins, DIAION® CRB03, CRB05 and others. The ratios of free basic group types and of the pH should be adjusted in advance of actual treatments; pH is 7 ~ 9.

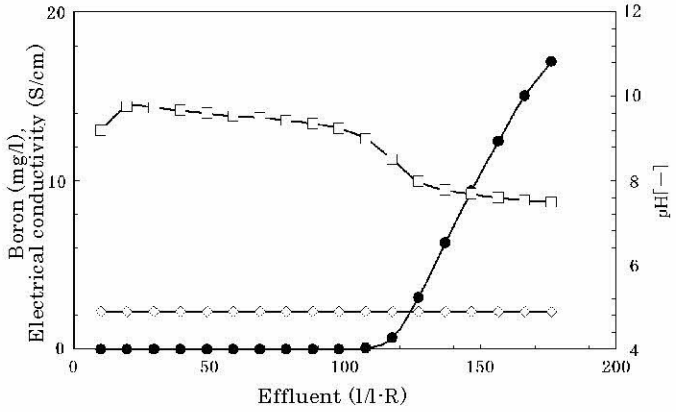
The pH of treated water becomes high at the initial step particularly. In

order to reduce such alkaline treated water, the ratio of free basic group types should be reduced by the limit of 50% since the adsorbing capacity decreases if the ratio is fewer than 50%. The adjustment of the ratios is as follows:

When the ratio is 75%, the resins are regenerated at the regeneration level of 75% versus the total exchange capacity. The relevant operations are 1) NaOH feed, 2) rince, 3) drainage of water by the resin surface, 4) distribute the remaining H_2SO_4-form resins at the bottom uniformly by air-mixing from the bottom and then to the next cycle.

Fig.VI-1-1 illustrates the equilibrium adsorptions of CRB03 and CRB05 and their break through capacities assuming that the break through point is 1 mg-B/L. The typical operation is demonstrated in Fig.VI-1-2[26].

Elution of boron from CRB is accomplished with mineral acids like H_2SO_4 and HCl. The method to recover boric acids from these eluted solutions with WBAERs is explained in Chapter VII, Clause 11.



[Fig.VI-1-2] Treatment example of Boron waste water with CRB05[26]

Resin:	CRB05	100mL
Regeneration:	H_2SO_4(5%)	80g/L-R
	NaOH(4%)	33g/L-R
Flow rate:	SV11	
Raw water:	pH=8.0	B=30mg/L
	Ca=0.62g/L	Na=4.7g/L
	SO_4=4.96g/L	Cl=4.16g/L
	NO_3=0.67g/L	

●: Boron, □: pH, ◇: Electrical conductivity