

Weakly Cation exchange resins

DIAION WK Series

Resins with carboxylic acid groups (-COOH) as ion-exchangeable groups are called WAC resins. They can exchange cations from bases like NaOH and salt of weak acids like NaHCO₃.

There are two types of WAC resins, polyacrylic acid type and polymethacrylic acid type. The polyacrylic acid type can be used at pH higher than 4, and the polymethacrylic acid type at pH higher than 5.

Because of their limit of pH, the use which the WACERs can be applied are less than the SACERs. However they have advantage that they are easily regenerated to H-forms.

Carboxylic acid groups (-COOH) don't dissociate in the acidic solutions, so the WACERs can't split neutral salts, such as NaCl and Na₂SO₄. However, they can exchange cations with bases like NaOH and with salt of weakly acids like NaHCO₃, as shown in Eq.II-1 and II-2.

- $\text{R-COOH} + \text{NaOH} \rightarrow \text{R-COONa} + \text{H}_2\text{O}$ (Eq. II-1)
- $\text{R-COOH} + \text{NaHCO}_3 \rightarrow \text{R-COONa} + \text{H}_2\text{O} + \text{CO}_2$ (Eq. II-2)

Though the selectivity of the WACERs toward each cation is almost the same as the one of the SACERs, the selectivity to H⁺ ion is one of the exceptions. So they are easy to be regenerated when we regenerate the cation exchange resins to their original R-SO₃H forms after they are used for the exchange with other cations. And slightly excess of regenerants are enough for regeneration.

The acrylic acid type is more acidic than the methacrylic acid one, so they are widely used in the treatment of the hard water of high bicarbonates concentration. In combined operations with the SACERs and the WACERs could often reduce regenerants totally, because the WACERs can be regenerated by the regeneration effluent of the SACERs.

Product	DIAION™ WK10	DIAION™ WK11	DIAION™ WK100	DIAION™ WT01S	DIAION™ WK40
Chemical structure	$\begin{array}{c} \text{CH}_3 \\ \\ -\text{CH}_2-\text{C}- \\ \\ \text{COOH} \end{array}$				$\begin{array}{c} -\text{CH}_2-\text{CH}- \\ \\ \text{COOH} \end{array}$
Appearance index	> 95			> 90	> 95
Apparent density (g/L-R)	615	665	670	765	805
Ion-exchange capacity (meq/mL)	> 2.5	> 2.9	> 2.8	> 3.0	> 4.4
Water content (%)	53-59	45-52	45-55	45-55	43-50
Particle size distribution > 1180 μm < 300 μm	< 5 % < 1 %			300 -106 μm > 85 %	< 10 % < 1 %
Effective size (mm)	> 0.40			0.10-0.14	> 0.40
Uniformity coefficient	< 1.6				< 1.7
Maximum temperature (°C)	< 150				< 120