AXION – RARE-EARTH AND NOBLE METALS CJSC
Voronezhskaya, 56, Perm, Russia, 614034
Tel. +7(342)253-07-67 доб. 565. Fax +7(342)253-07-69. E-mail: axion.rnm@gmail.com

NP, Mixed Acid Cation Resin

NP resin is constructed of a polyacrylic/divinylbenzene matrix in a spherical bead form. The resin is polyfunctional, containing α-amino-gem-diphosphonic and carboxylic acid groups bonded to the polymer matrix. The α-amino-gem-diphosphonic acid ligands contribute to the resin's unique selective capability by preferentially removing selected metals from the solution. In near neutral pH streams, NP resin has to be selective for non-ferrous, actinide and heavy metal cations over alkali cations. NP resin is highly selective for indium, scandium and lanthanide elements under strongly acidic conditions. The resin also removes ferric iron, chromium, uranium, plutonium, and certain metals other metals from strongly acidic solutions. Coordination of these metal cations to NP is unaffected by increasing hydrogen ion concentrations.

Table. Comparision of typical chemical and physical characteristics of NP resin and closest analogue Purolite® S955 (Diphonix).

Typical Chemical and Physical Characteristics	**NP (typical)**	**NP (actual)**	**Purolite® S955 (Diphonix)**
Polymer Matrix Structure	Crosslinked Polymer	Crosslinked Polymer	Crosslinked Polymer
Functional Groups	α-amino gem-diphosphonic, Carboxylic acid, Amide	α-amino gem-diphosphonic, Carboxylic acid, Amide	Diphosphonic, Sulphonic, Carboxylic acid
Ionic Form - as shipped	H^+	H^+	H^+ or Ca^{2+}/Mg^{2+}
Total Capacity (H^+ Form), eq/dry kg (min)	8	8,9	5,3
Moisture Retention (H^+ Form), %	40-50	46	54-60
Particle Size Range, microns	300-1100	300-1100	+850 <10%, -300 <2%
Specific Gravity	1,1-1,25	1,15	1,18-1,22
Shipping Weight, kg/m^3	650-720	715	775-855
Iron (III) Capacity, g/ dm^3 (min)	20	25	10
[1] Indium Capacity, g/ dm^3		54	
[1] Scandium Capacity, g/ dm^3		28	
[1] Neodymium Capacity, g/ dm^3		36	
[1] Thorium Capacity, g/ dm^3		81	
[1] Uranium Capacity, g/ dm^3		167	

[1] Measurement of Adsorption Capacity for Metal Ions (Batch Method)

AXION – RARE-EARTH AND NOBLE METALS CJSC
Voronezhskaya, 56, Perm, Russia, 614034
Tel. +7(342)253-07-67 доб. 565. Fax +7(342)253-07-69. E-mail: axion.rnm@gmail.com

Indium

In a glass-stoppered Erlenmeyer flask were placed 2 g of the resin (H^+ form) and 50 cm^3 of metal ion solution (0,1 M In^{3+} solution in 1 M H_2SO_4) and the mixture was left at room temperature (about 25°C) for 24 h with occasional shaking. The concentration of the indium in solution was analyzed using inductively coupled plasma optical emission spectrometry.

Indium capacity is 54 g/dm^3.

Scandium

In a glass-stoppered Erlenmeyer flask were placed 2 g of the resin (H^+ form) and 50 cm^3 of metal ion solution (0,1 M Sc^{3+} solution in 2 M H_2SO_4) and the mixture was left at room temperature (about 25°C) for 24 h with occasional shaking. The concentration of the scandium in solution was analyzed using inductively coupled plasma optical emission spectrometry.

Scandium capacity is 28 g/dm^3.

Neodymium

In a glass-stoppered Erlenmeyer flask were placed 2 g of the resin (H^+ form) and 50 cm^3 of metal ion solution (0,1 M Nd^{3+} solution in 2,8 M HNO_3 with 2,8 M $NaNO_3$) and the mixture was left at room temperature (about 25°C) for 24 h with occasional shaking. The concentration of the neodymium in solution was analyzed using inductively coupled plasma optical emission spectrometry.

Neodymium capacity is 36 g/dm^3**.**

Thorium

In a glass-stoppered Erlenmeyer flask were placed 0,1 g of the dry resin (H^+ form) and 20 cm^3 of metal ion solution (0,012 M Th^{4+} solution in 3 M HNO_3) and the mixture was left at room temperature (about 25°C) for 48 h with occasional shaking. The concentration of the thorium (IV) in solution was analyzed by titration of thorium (IV) - xylenol orange complex with DTPA.

Thorium capacity is 81 g/dm^3.

Uranium

In a glass-stoppered Erlenmeyer flask were placed 0,1 g of the dry resin (H^+ form) and 20 cm^3 of metal ion solution (0,025 M UO_2^{2+} solution in 3 M HNO_3) and the mixture was left at room temperature (about 25°C) for 48 h with occasional shaking. The concentration of the uranium (IV) in solution was analyzed by photometry using the arsenazo III method.

Uranium capacity is 167 g/dm^3.

Example of use NP

The pilot sample of NP by its capacity (16,6 g/dm^3) and selectivity (70 %) many times exceeds the characteristics of the other industrial ion-exchange resins in sorption from sulfuric solution after Waelz oxides recovering.

Advantages NP:

1. Single-stage recovery of indium from different solutions, including ones with low concentration of indium (0,1-0,15 g/dm^3) and high concentration of silicic acid (up to 0,9 g/dm^3 Si) without their preliminary removal.
2. High sorption efficiency of indium (16,6 g/dm^3);
3. The indium concentration in eluates about 70 % allows to obtain indium concentrate appropriate for further recovery of metallic indium;
4. Possibility of indium selective sorption from solutions with high content of sulfuric acid (up to 150 g/dm^3);

AXION – RARE-EARTH AND NOBLE METALS CJSC
Voronezhskaya, 56, Perm, Russia, 614034
Tel. +7(342)253-07-67 доб. 565. Fax +7(342)253-07-69. E-mail: axion.rnm@gmail.com

5. No organic impurities (leach, solvent, etc.) both in solutions at the stage of sorption and in eluates at the stage of desorption.