



WP-2 Packed Bed Resin Use Instructions and Limited Application Notes:

INSTRUCTIONS FOR USE:

WP-2 is a non-styrene resin that is composed of modified hydrophilic polymers grafted to amorphous silica gel.

- For bench testing the resin is normally packed into the column dry with light tapping.
- The resin must be conditioned by passing a minimum of two bed volumes of pH 2 sulfuric acid through the column. This is a once only requirement
- The cycles are then load, wash, elute, rinse, load etc. NO REPLACEMENT of either H⁺ or OH⁻ ions is required.
- The resin may be base regenerated for certain applications using either caustic soda (0.1 to 1.0 M) or 1-4M ammonia. Caustic soda > 1.0M should not be used.
- For pilot, or commercial, applications a resin slurry may be prepared using water prior to loading into the columns.

Note on Terminology:

The cycle above refers to load, wash, elute, and rinse that are defined as follows:

Load: This refers to loading the resin with metals to a specified percentage breakthrough

Wash: Refers to washing the fully loaded column with, usually, water to remove the interstitial feed liquor from the column (commercially, this wash water is normally

recycled back to the feed-in). It is possible from our experience from piloting in Ohio that you may call this rinse. The wash is normally finished in 1.5 to 1.8 BV depending on how high the target metals are in the feed PLS.

Elute: Refers to stripping or removing the loaded metals with acid – the acid can be H_2SO_4 , HNO_3 , HCl or alternatively ammonia can be used. Typically, the elution is complete in 1.5 to 2 BV

Using H_2SO_4 for Cu 25% w/v is used, for Ni around 13% w/v and for Co <5% w/v

Rinse: This is where the interstitial acid is rinsed from the column. (In some countries this may be referred to as wash) Typically 1.5 to 2 BV of water is required. Using Ni as an example the rinse water should contain ~ 11% free H_2SO_4 , for Cu ~ 18% free H_2SO_4 . The reason for this is that the resin is a multi-layered porous structure and the water removes both the interstitial acid plus the acid that has soaked into the porous structure. This rinse water is usually recycled back to the acid make-up tank for acid recovery. The true acid consumption is typically stoichiometric plus ~ 2%

Notes on Selectivity:

The resin will load ferric iron however rejects ferrous (except for a very minor ferrous to ferric conversion on the resin ligand)

Selectivity is pH related:

At pH <3.5 the resin will load Fe^{+3} , Cu, Ni, Co with binding affinities in the same order ($Fe^{+3} > Cu > Ni > Co$). The resin is designed to reject Na, K, Ca, and Mg

At pH > 3.5 the resin will start to load Al, Mn, Cd, Pb, Zn whilst still rejecting Na, K, Mg, Ca

At pH 11 the resin will co-load some Na, Mg, K, Ca

Notes on Circuit:

The resin should be used as a packed bed.

Backflushing is not usually required as part of the circuit however for a commercial design the ability to back-flush, if needed, should be incorporated.

The optimum PLS pH is ~ 2.3 for nickel or copper recovery.

Chemical Degradation:

The resin should not be used with HF due to its silica backbone nor should it be used with $NaOH > 1.0M$

Organics usually will not hurt the resin however please contact PSI if the PLS contains organics providing the nature (name) of the organic and the level. We will then confirm whether or not to take any special precautions.

Cobalt Oxidation State:

Cobalt ⁺³ may be difficult to elute from the resin and, if present, may reduce the loading capacity over time. Cobalt ⁺² has a relatively low binding affinity with the resin and is easily eluted with nominally 3% w/w H₂SO₄

Elution:

The resin can be eluted with concentrated H₂SO₄, HNO₃ & HCL if required.

Process PLS Temperature:

The resin can tolerate temperatures up to 110C

Kinetics:

The PSI WP-2 kinetics are extremely fast – feed rates well in excess of 30 BV per hour can usually be used.