PhosphonicS
SUSTAINABLE METAL RECOVERY

PhosphonicS

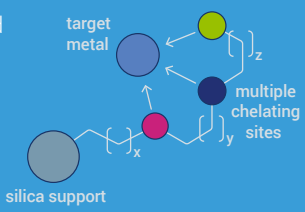
Silica Screening Guide: Recovery

SMART SILICA SCAVENGERS

PhosphonicS uses patented technology for attaching powerful ligands to an amorphous silica support.

The ability to incorporate multiple chelating sites enables our silica products to outperform other solid supported products in the removal of metals from your streams irrespective of the starting concentration.

The scavengers included in your kit have either been selected based on our understanding of your recovery requirements or include the scavengers that are typically most effective for scavenging common higher value metals.



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The following comments are based on years of experience screening scavengers to recover PGMs and other target metals from many process streams from a broad range of sources. 1

Our objective is to help you choose the statistically best performing scavengers to include in your screen. If you are only going to screen 1, 2 or 3 scavengers, then selection is especially important. We would always recommend screening >3 materials, but we also acknowledge this may not always be possible. We still get some surprises on which scavenger performs best so broad screening will provide better data for optimum scavenger selection.

In Table 1 for each scavenger we have colour coded its relative affinity to scavenge the metals in the table.

Very high affinity | High affinity | Some affinity

For each of the commonly used metals in catalysis, we have assigned the scavengers **1**, **2**, **3** or no assignment:

Assignment 1 means this scavenger has most fequently been the best scavenger compared to the other scavengers.

Assignment 2 means this scavenger has been the best scavenger on the second most frequent number of occasions.

Assignment 3 means this scavenger has been the best performing scavenger on the third most frequent number of occasions.

No assignment does not mean the scavenger has no affinity for the target metal, rather it is infrequently the best performing scavenger.

If more than one scavenger has the same numerical assignment, the scavengers have either performed similarly on process streams or performed best on a similar number of occasions.

Table 1

Silica Scavengers for Precious Metal Recovery

Code	Name	Functionality	Inc. in Kit	Au	Ir	Pd	Pt	Rh	Ru
SP157292	Phos-02	Aminoalkyl 3 functionalised silica		3	3	2	1	3	3
SP157295	Phos-03	Aminoalkyl 1 functionalised silica		2	3	3	3	3	3
SP156867	Phos-04	Mercaptoalkyl 1 functionalised silica		1	1	1	2	1	1
SP157293	Phos-05	Mercaptoalkyl 4 functionalised silica		1	1	1	2	1	1
SP157294	Phos-06	Alkyl thiourea functionalised silica		2	2	2	3	2	2

Phos-04 and Phos-05 show similar performance on process streams containing Pd and Au. In the same stream they will typically achieve similar levels of recovery and similar metal loadings. A notable exception is their comparative performance on Rh process streams. In some cases Phos-04 outperforms Phos-05 and in some cases the reverse is observed, with a 20-40% difference frequently observed between the two products for Rh recovery. We would recommend investigating both Phos-04 and Phos-05 for Rh and Phos-04 for Au, Ir, Pd, Pt, Rh and Ru. 2

Where only a limited selection of scavengers can be screened, then with the exception of Rh and Phos-04/-05, we would recommend selecting scavengers with assignments 1 and 2 (and preferably 3) that have different functionality. For example, if only 3 scavengers could be evaluated for Pd removal we would recommend screening Phos-4 (thiol), Phos-02 (amine) and Phos-06 (thiourea).

If you do not have time or resource to carry out screening yourselves, PhosphonicS provide a comprehensive screening service. We operate under strict CDA.

For silica scavengers for remediation of other metals please see over.

In Table 2 we have applied the same colour coding and numerical assignment for each scavenger's relative affinity and likelihood of being the best performing scavenger.

Table 2

Silica Scavengers for Remediation of Waste Streams

Code	Name	Inc. in Kit	Ag	As	Cd	Cr	Hg	Ni	Os	Pb	Sn
SP157292	Phos-02				3	2	2	3	1	1	2
SP157295	Phos-03					3	3	3	3	2	3
SP156867	Phos-04		3	1			1		1	1	1
SP157293	Phos-05		3	2			1		2	2	1
SP157294	Phos-06				1		2	3	3	1	1
SP157303	Phos-07				1	2		2		2	2
SP157299	Phos-08						3		2	2	
SP157301	Phos-09		1	3	2	3	3	2		3	2
SP157486	Phos-10		2		3	1	1	1		1	1
SP157302	Phos-11						2		3	2	2

Phos-09 is a mixed functionality. It is not first choice for any metals but has a very broad spectrum of metal removal capability. In some applications it is removing more than 20 different metals simultaneously and should be considered for inclusion in screening evaluation if there are multiple different metals to scavenge.

Important Notes:

- Liquid samples must be fully homogenised prior to testing
- A control reaction should be performed using identical reaction conditions in the absence of any scavenger
- A full risk assessment should be undertaken prior to any experimental work
- Silica particle size: 200-500 µm. Pore size: 150 Å

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Please speak to our experts for scavenging advice or to request additional or alternative scavengers.

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