

# Application Note M1.0

## Typical Experimental Conditions & Calculation

### STEP 1: SCREENING

To find out which **SiliaBond Metal Scavenger** will better suit your need, we recommend performing some screening (on small scale) using the **SiliaBond Metal Scavenger Kit** (Product # K30730B) to quickly determine which scavenger presents the highest efficiency and make experiment optimization from there.

#### TYPICAL EXPERIMENTAL PROCEDURE

Prepare six vials containing the same quantity of the solution to be treated with the **SiliaBond Scavengers** included in the kit.

1. For each **SiliaBond Metal Scavenger**, calculate the amount needed (4-8 eq.) in respect to the residual metal concentration. (See "Calculation of the amount of scavenger to use" section.)
2. Add the **SiliaBond** to the solution and stir for one hour at room temperature.
3. Filter off the **SiliaBond** using a fritted funnel or filtration device, and wash the scavenger with additional solvent for total recovery of the API.
4. Analyze the residual metal concentration of each vial to identify the most efficient scavenger (the one with the lowest residual metal concentration). You can choose more than one scavenger.
5. Follow the optimization steps with the **SiliaBond Metal Scavenger** identified in #4.



Note: the scavenging progress can be estimated by looking at the color of the solution as demonstrated in the figure. When the scavenging is almost completed, the solution is colorless and **SiliaBond Metal Scavenger** becomes coloured. If all the samples are still coloured, let them react for a longer time (ex.: 4 hours) and/or use more equivalents (at least 8 eq.).

### STEP 2: OPTIMIZATION

If, upon completion of the screening procedure, the scavenging is not completed and you are not satisfied with the scavenging efficiency or you wish to reduce the number of equivalents and the reaction time, the following steps should be undertaken:

- Increase the temperature of the scavenging reaction
- Modify the number of molar equivalents of the **SiliaBond Metal Scavenger**
- Change the reaction time
- Try a different and/or a mixture of **SiliaBond Metal Scavengers**

These parameters can be changed one at a time or simultaneously to improve the metal removal efficiency. It is important to underline that these scavengers are stable and work in any solvent.

**STEP 3: BULK (OR SPE) PROCEDURE**

Once the experimental conditions have been optimized (solvent, number of equivalents, temperature, and time), add the **SiliaBond Metal Scavenger** to the solution and stir mechanically at selected temperature for the determined period of time. Filter off the scavenger using a filtration device and wash the scavenger with solvent for total API recovery.

Alternatively, a packed cartridge (**SPE** or **Flash cartridge**) can be employed for metal removal. We recommend using at least 4 equivalents of the scavenger.



## Calculation example

### CALCULATION OF THE AMOUNT OF SILIABOND METAL SCAVENGER TO USE

To get an effective metal removal, the amount of **SiliaBond Metal Scavenger** used is very important. You can determine by two different ways how much scavenger will be needed; from the residual concentration (more

#### From residual metal concentration (ppm)

Knowing the palladium (Pd) level in 800 g of material is 500 ppm, (the oxidation state does not affect the calculation).

##### Data needed:

- **Loading of the scavenger (SiliaBond Thiol):** 1.2 mmol/g
- **Metal molecular weight:** Ex. Pd = 106.42 g/mol
- **Amount of product to be treated (containing the Pd):** Ex. 800 g
- **Residual concentration of metal:** Ex. 500 ppm of Pd

1. Determine the amount (g) of palladium to be scavenged

$$\text{Pd (mg)} = \frac{500 \text{ ppm} \times 800 \text{ g of material}}{1000} = 400 \text{ mg of Pd in 800g of material}$$

$$\text{Pd (mmol)} = \frac{400 \text{ mg}}{106.42 \text{ g/mol}} = 3.76 \text{ mmol of Pd}$$

2. Calculate the amount of scavenger (**SiliaBond Thiol**) to use (1 equivalent)

$$\text{Scavenger (g)} = \frac{3.76 \text{ mmol of Pd}}{1.2 \text{ mmol/g scavenger}} = 3.13 \text{ g of scavenger (1 eq)}$$

To scavenge 400 mg of palladium, 3.13 g of **SiliaBond Thiol** is needed if using only one equivalent. However, it is highly recommend trying a minimum of 4 equivalents at first. In this case, the amount of **SiliaBond Thiol** will be 4 times higher (4 x 3.13 g = 12.40 g).

#### From amount of metal catalyst used

Sometimes, the metal residual concentration is unknown. In such a case, the amount (g) of palladium to be scavenged can be replaced by the amount of metal catalyst used for the reaction:

##### Data needed:

- **Amount of metal catalyst used:** Ex. 10 g of Pd(PPh<sub>3</sub>)<sub>4</sub>
- **Metal catalyst molecular weight:** Pd(PPh<sub>3</sub>)<sub>4</sub> = 1155.56 g/mol

1. Determine the amount (g) of palladium to be scavenged

$$\text{Pd (mmol)} = \frac{10 \text{ g of Pd(PPh}_3)_4 \times 1000}{1155.56 \text{ g/mol}} = 8.65 \text{ mmol of Pd (max to be scavenged)}$$

The amount of **SiliaBond Thiol** to be used can then be determined as stated above (see 2. Calculate the amount of scavenger to use).

In this particular case, 1 equivalent of **SiliaBond Thiol** corresponds to 7.20 g.