# BabyBio NTA His-tag Screening kit
# BabyBio IDA His-tag Screening kit

BabyBio™ His-tag Screening kits contain columns prepacked with WorkBeads™ IDA and WorkBeads NTA charged with $Ni^{2+}$, $Co^{2+}$, $Cu^{2+}$ or $Zn^{2+}$ ions. The kits are excellent tools for screening combinations of metal ions and chelating ligand (NTA or IDA) to optimize purity and yield when purifying polyhistidine-tagged (His-tagged) proteins. Other native proteins containing histidine, cysteine and tryptophan residues may also bind and can therefore be purified using these columns. The selected column can easily be used to purify up to 70 mg and 350 mg protein respectively using a 1 ml or 5 ml column.

- Pre-charged columns with different metal ions for convenient screening for optimal purity
- Ready-to-use columns for fast results
- High binding capacity and purity


## Short protocol

This general short protocol is for usage of BabyBio His-tag Screening kits. Detailed instructions and recommendations for optimization are provided later in this instruction. Recommended buffers are listed in Table 2.

1. Connect the column to the chromatography system, syringe or pump.
2. Equilibrate the column using 10 column volumes (CV) binding buffer.
3. Apply a clarified sample in the pH range 7 - 8.5. The sample should contain 10 mM imidazole.
4. Wash the column using 20 - 30 CV washing buffer.
5. Elute the target protein.
   *Alternative 1*: Desorb the target protein with 5 CV elution buffer.
   *Alternative 2*: For increased purity, gradient elution is recommended. For example, a gradient from 10 mM to 300 mM imidazole over 20 CV.
   After the elution re-equilibrate the column with 10 CV binding buffer.
6. Wash the column with 5 CV deionized water to remove the elution buffer.
7. Equilibrate the column with 5 CV 20% ethanol for storage. Close the column using the included cap and plug.

### Metal ion screening

Duplicate the same purification protocol for all columns in the kit by applying a sample containing approximately 0.2 - 2 mg His-tagged protein. Select the column that gives the highest purity and yield. Usually a tradeoff between purity and yield must be made. Scale-up the purification on the selected column by increasing the sample load. Loads of up to approx. 30 - 50 mg of target protein for BabyBio 1 ml and 150 - 250 mg for BabyBio 5 ml are recommended.

**Note:** The purity and yield obtained may differ depending on sample composition, target protein properties, selected column and conditions. Selection of stringent conditions may give reduced binding capacities.

## Principle

Immobilized Metal Ion Affinity Chromatography (IMAC) utilizes the affinity of histidine, cysteine and tryptophan amino acid side chains on the protein surface for binding to transition metal ions, such as $Ni^{2+}$, $Co^{2+}$, $Cu^{2+}$ and $Zn^{2+}$, immobilized via a metal chelating ligand on the chromatography resin. WorkBeads resins are available with nitrilotriacetic acid (NTA) or iminodiacetic acid (IDA) chelating ligands as illustrated in Figure 1.

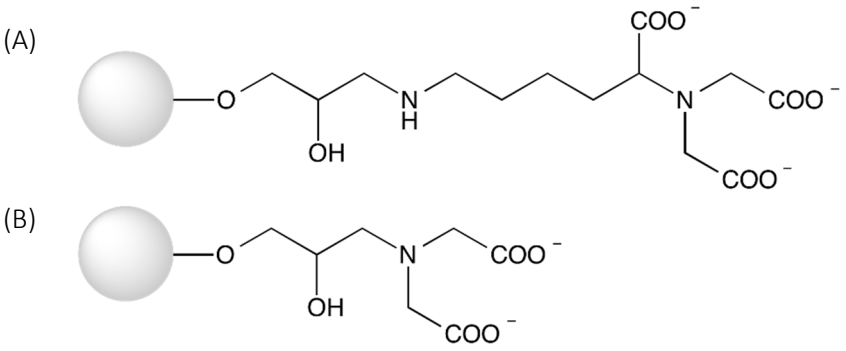


Figure 1. Structure of the chelating ligand used in WorkBeads 40 NTA (A) and WorkBeads 40 IDA (B) resins.

IMAC is commonly used for the purification of recombinant His-tagged proteins. The His-tag is usually composed of six to ten histidyl groups, and is typically placed at the N- or C-terminus of the target protein, although other positions are possible. His-tagged proteins will bind to the chelating ligand (through the metal ion) and unbound material will pass through the column. Bound proteins are desorbed by stepwise or gradient elution using a competing agent, or by applying a low pH buffer. BabyBio Ni-NTA columns are recommended as the primary choice for His-tagged protein purification and usually will give excellent results. For more difficult purifications, a screening is recommended using the eight available different pre-charged WorkBeads IMAC resins are recommended to find the optimal combination of ligand and metal ion, see *Related products*. Bio-Works also offer two different Screening kits with pre-charged WorkBeads IMAC resins prepacked in BabyBio 1 ml and 5 ml columns.

Imidazole is recommended for elution. This is the most commonly used competing agent but histidine, ammonium chloride or histamine can also be used. Before sample application the column should be equilibrated with a low concentration of the competing ligand in order to prevent non-specific binding of endogenous proteins that may bind via histidine clusters for example. This can easily be done using the recommended binding buffer.

Elution with a continuously decreasing pH gradient is an alternative to imidazole and after optimization a pH step gradient may be more appropriate for scale-up. At pH 3 - 5, the histidine residues ($pK_a$ approx. 6) are protonated which leads to the loss of affinity for the metal ion and thus to the release of the protein. It is important to consider the target protein stability at low pH.

### Metal ion screening

When purifying a protein using IMAC, the affinity and selectivity for the protein are dependent on the metal ion and the structure of the chelating ligand. Generally, His-tagged proteins can be successfully purified with BabyBio Ni-NTA, but it is worthwhile to screen other metal ion and chelating ligand combinations to reduce the binding of host cell proteins. This is especially worth considering when purifying proteins expressed in yeast and mammalian cells since the set of impurities are much more complex in extracts from these systems than for proteins expressed in bacteria including *E. coli*. The combination of metal ion and chelating ligand that works best for a certain protein is difficult to predict. Screening proteins with immobilized $Ni^{2+}$, $Co^{2+}$, $Cu^{2+}$ and $Zn^{2+}$ will generate the metal ion with the most optimal affinity and selectivity for the target protein in combination with the chosen chelating ligand. Screening for metal ion and chelating ligand is also recommended for purification of native proteins containing histidine, cysteine or tryptophan residues.

## Instructions

Purification can be carried out at room temperature or at temperatures down to 4°C. Operation at a low temperature may require a reduced flow rate due to the increased viscosity of the buffer. All steps can be carried out with a syringe, a peristaltic pump or a chromatography system. If the chromatography system has a pressure limit functionality, set the maximum pressure over the column to 3 bar (remember to take the system fluidics contribution to the pressure into account).

### 1. Prepare the sample

After cell disruption or extraction, clarify the sample by centrifugation at 10 000 - 20 000 × *g* for 15 - 30 minutes. It is generally recommended also to pass the sample through a 0.22 - 0.45 µm filter (e.g., a syringe filter) to avoid inadvertently applying any remaining particles onto the column. If the sample contains only small amounts of particles, centrifugation may be omitted and it is enough only to carry out filtration. Application of a sample that has not been properly clarified may reduce the performance and lifetime of the column. The sample should be applied under conditions similar to those of the binding buffer. Add imidazole to the sample to have the same concentration as in the binding buffer.

### 2. Connect the column

Cut off or twist off the end at the outlet of the column, see Figure 2. **Note:** It is of high importance to cut off the tip at the very end of the cone, preferable using a scalpel. Incorrect removal of the end piece will affect the performance of the column.

Connect the column to your equipment using the recommended connectors shown in Table 1. Fill the equipment with deionized water or buffer and make drop-to-drop connection with the column to avoid getting air into the column. Carry out all steps, except for sample application, at 1 ml/min (BabyBio 1 ml column) or 5 ml/min (BabyBio 5 ml column).


Figure 2. Removal of the cut-off end at the column outlet should be done by cutting or by twisting (A) not bending (B).

Table 1. Recommended connectors for coupling BabyBio columns to the equipment of choice.

| Equipment | Accessories for connection |
|---|---|
| Syringe | Female luer or male coned 10 - 32 threads |
| Chromatography system | Fingertight connectors (coned 10 - 32 threads) for 1/16” o.d. tubing |

### 3. Remove the storage solution

The column contains 20% ethanol on delivery. This storage solution should be washed out before use. Wash the column with 5 CV deionized water or buffer. Avoid flow rates higher than 2 ml/min for BabyBio 1 ml columns or 10 ml/min for BabyBio 5 ml columns before the storage solution has been removed to avoid overpressure due to high viscosity of the 20% ethanol solution.

### 4. Equilibrate the column

Equilibrate the column with 5 - 10 CV of binding buffer (see Table 2 for recommended buffers). Other neutral buffers, with at least 10 mM of imidazole, can also be used.

Table 2. Recommended buffers for purification. Other buffers can be used.

| Buffer | Composition |
|---|---|
| Binding buffer | 50 mM Na-phosphate buffer, 300 mM NaCl, 10 mM imidazole, pH 8.0 |
| Washing buffer | 50 mM Na-phosphate buffer, 300 mM NaCl, 20 - 100 mM imidazole, pH 8.0 |
| Elution buffer | 50 mM Na-phosphate buffer, 300 mM NaCl, 300 mM imidazole, pH 8.0 |

**Note:** To avoid bacterial growth and poor column performance, use only freshly prepared and filtered buffers.

### 5. Apply the sample

Apply the sample at 0.5 - 1 ml/min for the BabyBio 1 ml or 2 - 5 ml/min for the BabyBio 5 ml columns. A too high flow rate may reduce the yield.

### 6. Wash

After sample application, remove unbound impurities by washing the column with 20 - 30 CV of washing buffer or until desired $A_{280\ nm}$ absorbance of the wash fractions (e.g., 0.01 - 0.02) is obtained. The binding buffer can be used instead of the washing buffer if the target protein binding is weak. However, this may decrease the final purity. If a gradient elution is planned, the binding buffer may be used for washing since most of the impurities will be eluted earlier than the His-tagged protein during the elution.

### 7. Elute

*Alternative 1*: Desorb the target protein with 5 CV elution buffer.
*Alternative 2*: For increased purity, gradient elution is recommended. For example, a gradient from 10 mM to 300 mM of imidazole over 20 CV can be applied.

### 8. Re-equilibrate

Before the next purification, re-equilibrate the column with 10 CV binding buffer.

### 9. Remove the elution buffer

Wash the column with 5 CV deionized water to remove the salts of the elution buffer.

### 10. Column storage

Equilibrate the column with 5 CV 20% ethanol for storage. Close the column using the cap and plug (included).

### 11. Metal ion screening

Repeat the same purification protocol for all columns in the kit by applying a sample containing approximately 0.2 - 2 mg His-tagged protein. Select the column that gives the highest purity and yield. Scale-up the purification on the selected column by increasing the sample load to up to ca 30 - 50 mg of target protein (BabyBio 1 ml) or 150 - 250 mg (BabyBio 5 ml).

**Note:** The protein binding capacity may differ depending on target protein properties, selected column and conditions.

## Using the screening kit

The screening of metal ions on BabyBio NTA or BabyBio IDA columns should be carried out by repeating the same purification procedure for the different metals. Apply the same amount of sample in each purification. Choose an amount of sample that allows monitoring of the UV trace during chromatography, and follow up with purity analysis (e.g., SDS-PAGE). It is recommended to apply gradient elution, since the required concentration of elution agent, e.g., imidazole, will change depending on the strength of the interaction between the target protein and the different metal ion charged resins. A late elution of the target protein indicates that the affinity is strong. The target protein may be found in the flow through if the affinity is too low for the tested metal ion. After the screening runs are completed compare the obtained purity and yield and select the best metal ion/ligand for scale-up.

Application data for the screening kits can be found in the BabyBio His-tag Screening kit Data sheet, DS 45 700 010, available on www.bio-works.com

## Purification additives

The pre-charged BabyBio columns are compatible with a multitude of additives, including various buffer substances, salts, detergents and stabilizers. Integral membrane proteins can be purified in the presence of detergents. Denaturing agents such as guanidine-HCl or urea can be used, although they may denature the target protein. Proteins expressed as inclusion bodies often have an incomplete folding. Dissolution of the inclusion body followed by IMAC purification in the presence of a denaturing agent, and finally renaturation is sometimes done, although significant further development may be required to obtain native protein structure.

**Note:** The use of chelating substances and reducing agents should be avoided. If needed, Tris(2-carboxyethyl)phosphine (TCEP) is recommended as reducing agent.

## Scale-up

Precharged BabyBio NTA and BabyBio IDA 1 ml columns are commonly used for purification of up to 50 mg of protein sample, but a capacity of up to 70 mg/ml is often possible. However, this depends on the properties (mainly size) of the target protein. The capacity is also dependent on the sample composition and conditions used for the purification. Scale-up from a BabyBio 1 ml column can easily be done by using a BabyBio 5 ml column and applying a sample volume five times larger. BabyBio columns can be connected in series with a maximum of five columns (column stacking). This will increase the capacity accordingly. By connecting BabyBio columns in series, column volumes from 1 ml to 25 ml can be obtained. This means a binding capacity of 1000 mg of His-tagged protein can be achieved.

BabyBio columns can be connected together easily without accessories. The pressure drop across each column bed will be the same as for a single column, but the upstream columns will be exposed to a higher internal pressure since it is affected by the added pressure drops across the downstream columns. It may therefore be necessary to decrease the flow rate accordingly to avoid reaching the maximum pressure limit in the first column. If possible, the maximum pressure of the chromatography system should be set according to Table 3. Remember to take the system fluidics contribution to the pressure into account.

Table 3. Recommended maximum pressure settings for BabyBio columns connected in series. Notice that the maximum pressure over each column is always 3 bar.

| Number of columns in series | Max pressure BabyBio 1 ml (bar) | Max pressure BabyBio 5 ml (bar) |
|---|---|---|
| 1 | 3.0 | 3.0 |
| 2 | 6.0 | 6.0 |
| 3 | 9.0 | 9.0 |
| 4 | 12 | 10[1] |
| 5 | 15 | 10[1] |

1 The maximum pressure is defined by the column hardware maximum pressure.

The column size should be selected based on the estimated amount of protein to be purified. A test run with a defined small volume of sample on a BabyBio 1 ml column should be used to estimate the concentration of the target protein in the sample. A general recommendation is to use 70 - 80% of the column binding capacity. For large sample volumes with low concentrations of the target protein, it may be suitable to use a larger column than the calculated one to allow higher sample flow rates, and consequently shorter application time. For example, using a 5 ml column instead of a 1 ml column allows a flow rate five times higher due to the larger cross-section of the column. Have in mind that too high flow rate may reduce the binding capacity.

For columns larger than 20 ml, it is recommended to pack a single column using bulk resin as the limitations of column stacking will then impact chromatographic performance. To find out more about Bio-Works bulk chromatography resins, please visit www.bio-works.com

## Optimization

The following paragraphs will give indications on some parameters that can be tuned to find the optimal conditions for the purification.

### Optimization of the binding

#### Low imidazole concentration

The sample and the binding buffer should contain a low concentration of imidazole, but not below 10 mM, to reduce unwanted binding of host cell proteins and to avoid pH effects that may interfere with the protein binding. Keep in mind that if the imidazole concentration is too high the His-tagged protein will not bind at all. Use high quality imidazole which has little or no absorbance at 280 nm.

#### Slightly basic pH

Binding of His-tagged proteins is preferably carried out at pH 7 - 8.5. At lower pH the histidine residues will be protonated (p$K_a$ approx. 6) and will not bind to the column.

#### Tuning the flow rate

Binding of His-tagged proteins to a metal chelating column is a rather fast mechanism, and a high flow rate will usually not affect the yield when moderate loadings are applied. At low temperature or for exotic protein or sample composition, it may be useful to lower the flow rate.

#### Addition of a denaturing agent

If the target protein is insoluble or present as inclusion bodies it can be dissolved by using a denaturing agent (e.g., 8 M urea or 6 M guanidine-HCl). The denaturing agent should be included in all buffers during the purification. The protein is usually denatured by the treatment. In some cases, subsequent renaturation is desired.

## Optimization of washing and elution

### Prolonged or harsher wash

A continuously decreasing UV signal is an indication of unbound material being washed out. The washing buffer applied should be continued, until the UV signal is stable and the same as for the washing buffer. The binding affinity for some His-tagged proteins may be very strong due to extra His-residues on the protein surface or to multimeric properties. In this instances use more stringent washing conditions (higher concentration of imidazole), which can give higher purity.

### Increased imidazole concentration

An additional washing step with a higher imidazole concentration in the washing buffer can be tested. Note that if the imidazole concentration is too high it may cause premature elution of the target protein.

### Additives

In IMAC, 300 - 500 mM NaCl is usually included in the eluents to reduce electrostatic interactions. In rare cases, it may be worthwhile to optimize the ionic strength. Other parameters such as pH and additives can be considered for optimization to increase the purity and stability of the target protein.

### Optimizing elution conditions

Elution can be performed using a high imidazole concentration (but rarely higher than 300 mM). A stronger binding may require higher imidazole concentrations for elution. Aggregates of His-tagged protein bind via multiple tags, thus increasing the affinity. By optimizing the imidazole concentration, it is possible to elute the His-tagged protein separately from the aggregates.

### Step elution

The optimal imidazole concentration is dependent on the purity and recovery requirements as well as the properties of the target protein and the sample. Applying gradient elution often gives increased purity than step elution, but step elution may be desired to obtain the highest possible concentration of the target protein and also when scaling up. In order to optimize the imidazole concentration for step elution an initial linear gradient test run should be performed to obtain suitable step elution conditions, see Figure 3.

**Note:** Remember to take the system dead volume into account when comparing the print out of the gradient and the trace.

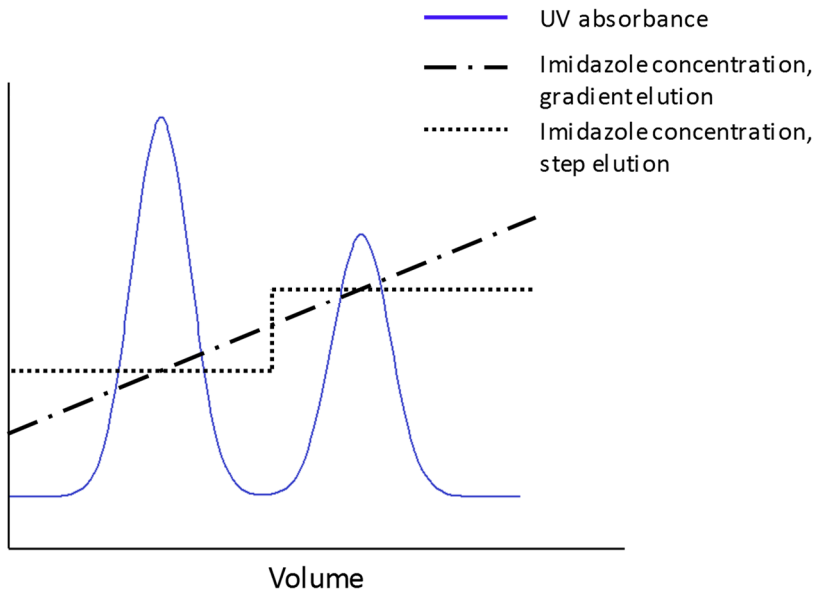


Figure 3. Optimization of step elution with imidazole. A test run with linear gradient elution gives information about suitable imidazole concentrations to be used in step elution.

### Extra purification step

Optimization of the overall purification process by tuning the binding, washing and/or elution steps, is a possibility. However, an extra purification step based on another chromatography technique is recommended (see *Additional purification*).

## Desalting and buffer exchange

Buffer exchange or desalting of a sample is often necessary before analysis and/or after chromatography steps such as IMAC purification. This can be carried out quickly and easily using BabyBio Dsalt 1 ml or 5 ml columns (see *Related products*). BabyBio Dsalt columns are also useful for the dialysis of larger sample volumes or when samples need to be processed rapidly, to avoid degradation.

## Additional purification

Optimized His-tagged protein purification on metal ion charged BabyBio columns gives high purity in a single step. For very high purity requirements, it can be necessary to add a second purification step. The additional purification step is used to remove remaining proteins and/or impurities from the sample. WorkBeads 40/1000 SEC, WorkBeads 40/100 SEC and WorkBeads 40/10 000 SEC resins facilitate the purification of target proteins of different size. WorkBeads 40S, WorkBeads 40Q and WorkBeads 40 DEAE resins are excellent for ion exchange chromatographic purification. These resins are also available as ready-to-use BabyBio Q, BabyBio S and BabyBio DEAE columns, as well as prepacked OptioBio 40S 10x100 and OptioBio 40Q 10x100 columns with 7.9 ml column volume.

To find out more about Bio-Works chromatography resins for additional purification, please visit www.bio-works.com

# Maintenance of the column

## Unpacking and inspection

Unpack the shipment as soon as it arrives and inspect it for damage. Promptly report any damage or discrepancies to your local supplier.

## Cleaning and recharging with metal ions

During purification impurities such as cell debris, lipids, nucleic acids and protein precipitates from the samples may gradually build up in the resin. The severity of this process depends on the type of sample applied to the column, and the pre-treatment of the sample. The bound impurities may reduce the performance of the packed column over time. Regular cleaning (Cleaning-in-place, CIP) keeps the resin clean, reduces the rate of further contamination, and prolongs the capacity, resolution and flow properties of the column. Cleaning using 1 M NaOH applied by a low reversed flow for 2 hours or overnight is often sufficient.

It is important to strip off the metal ions, before cleaning and then recharge the resin with fresh metal ions. If the resin is packed in a column; stripping, cleaning and recharging the resin can be carried out as followed:

**Wash with:**

1. 5 CV deionized water
2. 10 CV 50 mM $Na_2EDTA$, pH 8.0
3. 10 CV 100 mM NaOH
4. 10 CV deionized water
5. 2 CV 50 mM metal salt solution in deionized water
6. 10 CV deionized water
7. 10 CV 20% ethanol (for storage)

Sanitization (reduction of microorganisms) can be done using combinations of NaOH and ethanol (e.g., incubation with a mixture of 0.5 M NaOH and 40% ethanol for 3 hours). The sanitization procedure and its effectiveness will depend on the microorganisms to be removed, and needs to be evaluated for each case.

**Note:** BabyBio IMAC columns pre-charged with metal ions are produced under controlled conditions. Restoring full functionality after cleaning and recharging with metal ions is the responsibility of the user, and is not guaranteed by the manufacturer.

## Storage

Equilibrate the column in 20% ethanol and close it securely using the included plug and cap. Store the column at 2 to 25°C.

# Additional information

## Intended use

BabyBio columns are intended for research and process development only. BabyBio columns shall not be used for preparation of material for clinical or diagnostic purposes.

## Safety

Please read the associated Safety Data Safety (SDS) for BabyBio columns, and the safety instructions for any equipment to be used. Nickel and cobalt salts are considered to be allergenic and potentially carcinogenic. Use recommended safety equipment. Note that the maximum backpressure of BabyBio NTA and BabyBio IDA columns is 0.3 MPa (3 bar, 43 psi).

## Product information

| | BabyBio: Ni-NTA, Co-NTA, Cu-NTA, Zn-NTA | BabyBio: Ni-IDA. Co-IDA, Cu-IDA, Zn-IDA |
|---|---|---|
| Target substance | His-tagged proteins, proteins containing histidine, cysteine and/or tryptophan amino acid side chains | His-tagged proteins, proteins containing histidine, cysteine and/or tryptophan amino acid side chains |
| Resin | WorkBeads 40 Ni-NTA<br>WorkBeads 40 Co-NTA<br>WorkBeads 40 Cu-NTA<br>WorkBeads 40 Zn-NTA | WorkBeads 40 Ni-IDA<br>WorkBeads 40 Co-IDA<br>WorkBeads 40 Cu-IDA<br>WorkBeads 40 Zn-IDA |
| Matrix | Rigid, highly cross-linked agarose | Rigid, highly cross-linked agarose |
| Average particle size[1] ($D_{V50}$) | 45 µm | 45 µm |
| Ligand | Nitrilotriacetic acid (NTA) | Iminodiacetic acid (IDA) |
| Metal ion | $Ni^{2+}$, $Co^{2+}$, $Cu^{2+}$ or $Zn^{2+}$ | $Ni^{2+}$, $Co^{2+}$, $Cu^{2+}$ or $Zn^{2+}$ |
| Static binding capacity[2] | 70 mg His-tagged protein/ml resin | NA |
| Dynamic binding capacity[2] | 50 mg His-tagged protein/ml resin | NA |
| Column volume | 1 ml<br>5 ml | 1 ml<br>5 ml |
| Column dimension | 7 x 28 mm (1 ml)<br>13 x 38 mm (5 ml) | 7 x 28 mm (1 ml)<br>13 x 38 mm (5 ml) |
| Recommended flow rate | | |
| BabyBio 1 ml | 1 ml/min (150 cm/h) | 1 ml/min (150 cm/h) |
| BabyBio 5 ml | 5 ml/min (225 cm/h) | 5 ml/min (225 cm/h) |
| Maximum flow rate[3] | | |
| BabyBio 1 ml | 5 ml/min (780 cm/h) | 5 ml/min (780 cm/h) |
| BabyBio 5 ml | 20 ml/min (900 cm/h) | 20 ml/min (900 cm/h) |
| Maximum back pressure | 0.3 MPa, 3 bar, 43 psi | 0.3 MPa, 3 bar, 43 psi |
| Chemical stability | Chelating substances (e.g. EDTA) will strip off the metal ions.<br>Stripped column: 10 mM HCl (pH 2), 10 mM NaOH (pH 12),<br>100 mM sodium citrate-HCl (pH 3), 6 M guanidine-HCl. | |
| pH stability | 7 - 9 (working range)<br>2 - 12 cleaning (stripped resin)<br>Do not keep the resin at low pH for prolonged time | 7 - 9 (working range)<br>2 - 12 cleaning (stripped resin)<br>Do not keep the resin at low pH for prolonged time |
| Storage | 2 to 25°C in 20% ethanol | 2 to 25°C in 20% ethanol |

1. The median particle size of the cumulative volume distribution.
2. The binding capacity is determined using a BabyBio Ni-NTA 1 ml. The binding capacity is dependent on the size of the target protein, and on the competition with other substances.
3. Aqueous buffers at 20°C. Decrease the maximum flow rate if the liquid has a higher viscosity. Higher viscosities can be caused by low temperature (use half of the maximum flow rate at 4°C), or by additives (e.g. use half of the maximum flow rate for 20% ethanol).

## Related products

| Product name | Pack size[1] | Article number |
|---|---|---|
| **Prepacked columns** | | |
| BabyBio Dsalt 5 ml | 5 ml x 5 | 45 360 107 |
| BabyBio Ni-NTA 1 ml | 1 ml x 5 | 45 655 103 |
| BabyBio Co-NTA 1 ml | 1 ml x 5 | 45 655 133 |
| BabyBio Cu-NTA 1 ml | 1 ml x 5 | 45 655 123 |
| BabyBio Zn-NTA 1 ml | 1 ml x 5 | 45 655 143 |
| BabyBio Ni-IDA 1 ml | 1 ml x 5 | 45 655 003 |
| BabyBio Co-IDA 1 ml | 1 ml x 5 | 45 655 033 |
| BabyBio Cu-IDA 1 ml | 1 ml x 5 | 45 655 023 |
| BabyBio Zn-IDA 1 ml | 1 ml x 5 | 45 655 043 |
| BabyBio S 5 ml | 5 ml x 5 | 45 200 107 |
| BabyBio Q 5 ml | 5 ml x 5 | 45 100 107 |
| BabyBio DEAE 5 ml | 5 ml x 5 | 45 150 107 |
| OptioBio 40S 10x100 | 7.9 ml x 1 | 55 420 011 |
| OptioBio 40Q 10x100 | 7.9 ml x 1 | 55 410 011 |
| **Bulk resins** | | |
| WorkBeads 40 Ni-NTA | 25 ml | 40 651 001 |
| WorkBeads 40 Co-NTA | 25 ml | 40 651 401 |
| WorkBeads 40 Cu-NTA | 25 ml | 40 651 301 |
| WorkBeads 40 Zn-NTA | 25 ml | 40 651 504 |
| WorkBeads 40 Ni-IDA | 25 ml | 40 650 001 |
| WorkBeads 40 Co-IDA | 25 ml | 40 650 401 |
| WorkBeads 40 Cu-IDA | 25 ml | 40 650 301 |
| WorkBeads 40 Zn-IDA | 25 ml | 40 650 501 |
| **Accessories** | | |
| Column plug male 1/16'' | 10 | 70 100 010 |
| Column cap female 1/16'' | 10 | 70 100 020 |

1. Other pack sizes can be found in the complete product list on www.bio-works.com

## Ordering information

| Product name | Pack size | Article number |
|---|---|---|
| BabyBio NTA His-tag Screening kit 1 ml[1] | 1 ml x 4 | 45 700 101 |
| BabyBio NTA His-tag Screening kit 5 ml[1] | 5 ml x 4 | 45 700 102 |
| BabyBio IDA His-tag Screening kit 1 ml[1] | 1 ml x 4 | 45 700 001 |
| BabyBio IDA His-tag Screening kit 5 ml[1] | 5 ml x 4 | 45 700 002 |

1. Includes one column each charged with $Ni^{2+}$, $Co^{2+}$, $Cu^{2+}$ or $Zn^{2+}$

Orders: sales@bio-works.com or contact your local distributor.
For more information about local distributor and products please visit www.bio-works.com or contact us at info@bio-works.com

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