



Version 3 ▼

Oct 19, 2022

# PCR cleanup and size selection with magnetic beads V.3

In 4 collections

Dominik Buchner<sup>1</sup><sup>1</sup>University of Duisburg-Essen, Aquatic Ecosystem Research

1 Works for me

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[dx.doi.org/10.17504/protocols.io.36wgqj45xvk5/v3](https://dx.doi.org/10.17504/protocols.io.36wgqj45xvk5/v3)

Dominik Buchner

University of Duisburg-Essen, Aquatic Ecosystem Research

## ABSTRACT

This protocol describes how to clean up PCR products or DNA extracts and perform a size selection with carboxylated-magnetic beads and a PEG-NaCl buffer. It can also be used for volume reduction of a sample or for buffer exchange.

## DOI

[dx.doi.org/10.17504/protocols.io.36wgqj45xvk5/v3](https://dx.doi.org/10.17504/protocols.io.36wgqj45xvk5/v3)

## PROTOCOL CITATION

Dominik Buchner 2022. PCR cleanup and size selection with magnetic beads. **protocols.io**<https://dx.doi.org/10.17504/protocols.io.36wgqj45xvk5/v3>

Version created by Dominik Buchner

## COLLECTIONS ⓘ



Invertebrate bulk sample metabarcoding protocol collection



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Invertebrate bulk sample metabarcoding protocol collection

## KEYWORDS

pcr cleanup, carboxylated beads, magnetic beads, PEG-NaCl precipitation, size selection, buffer exchange

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## CREATED

Oct 19, 2022

LAST MODIFIED

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PROTOCOL INTEGER ID

71537

PARENT PROTOCOLS

Part of collection

[Invertebrate bulk sample metabarcoding protocol collection](#)

[Invertebrate bulk sample metabarcoding protocol collection](#)

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GUIDELINES

Follow general lab etiquette. Wear gloves to prevent contaminating the samples. Clean the workspace before starting with 80% EtOH.

Ratio Guide:

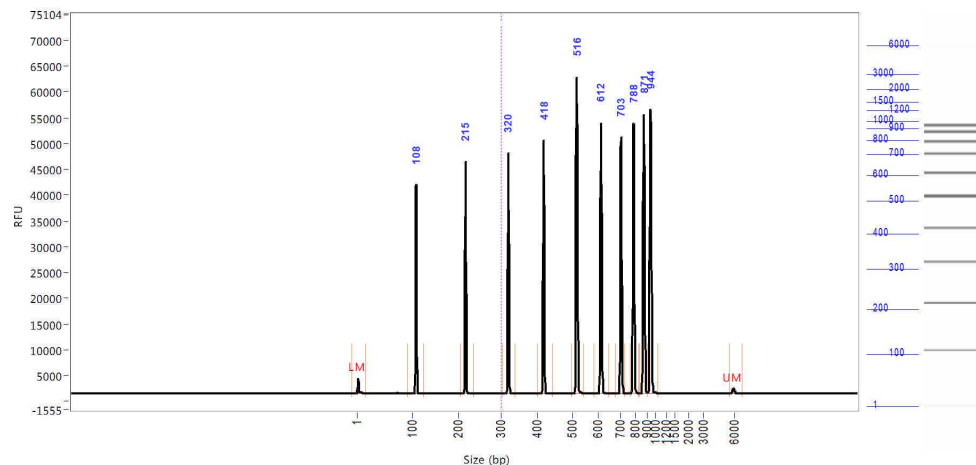
To get an estimate the performance of different ratios the protocol was tested using a DNA Ladder

[GeneRuler 100 bp DNA Ladder ready-to-use](#) **Thermo Fisher**

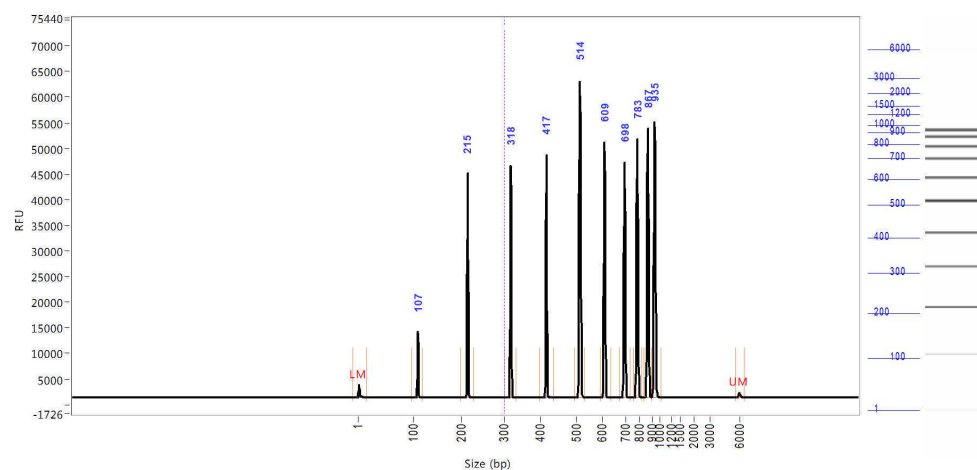
**Scientific Catalog #SM0243**

. The eluate was then measured using a Fragment Analyzer with the High Sensitivity Kit.

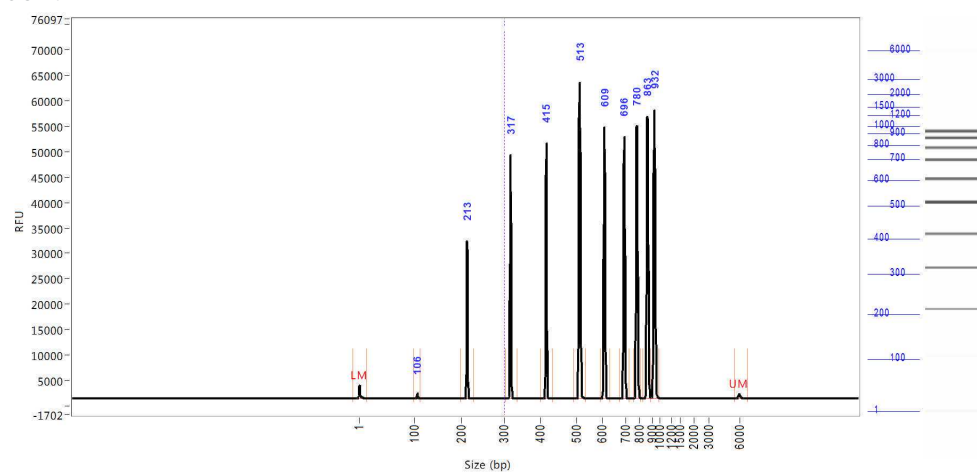
Input DNA:



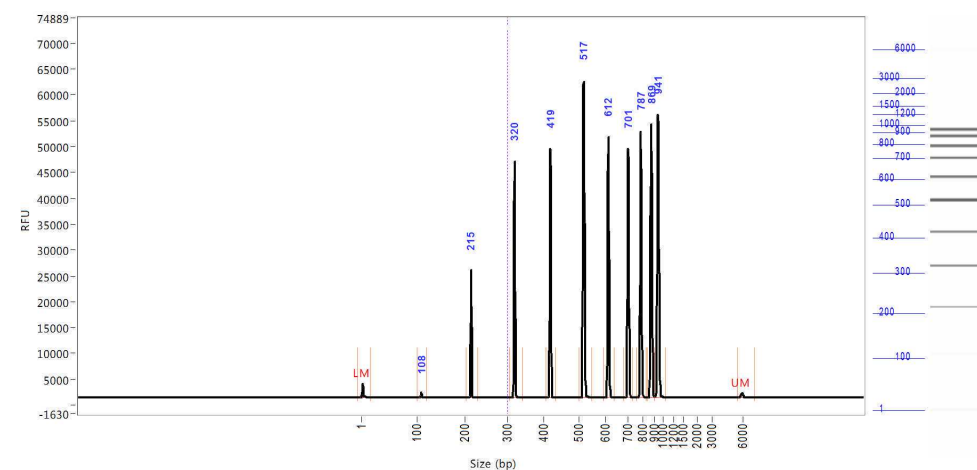
Ratio 1.8:



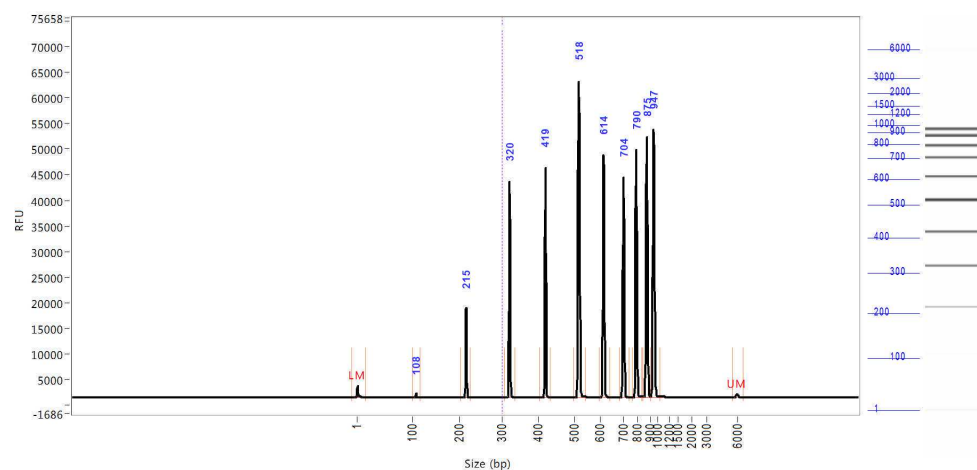
Ratio 1:



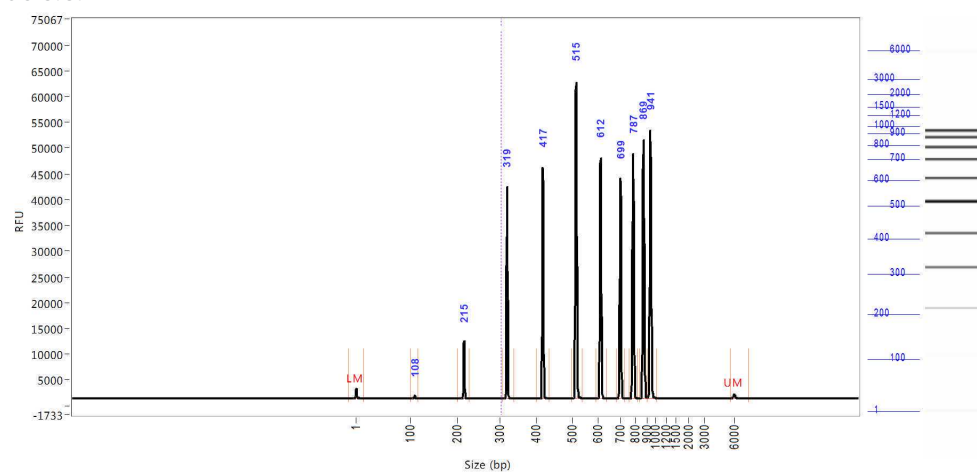
Ratio 0.9:



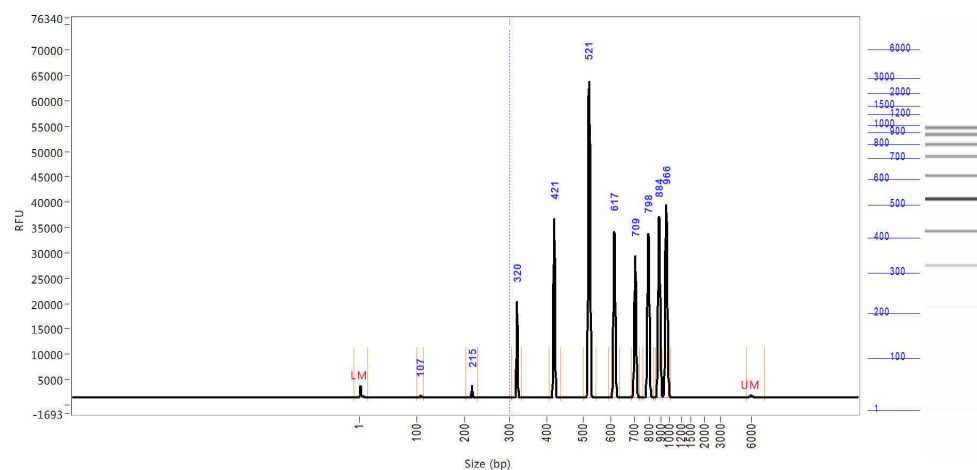
Ratio 0.85:



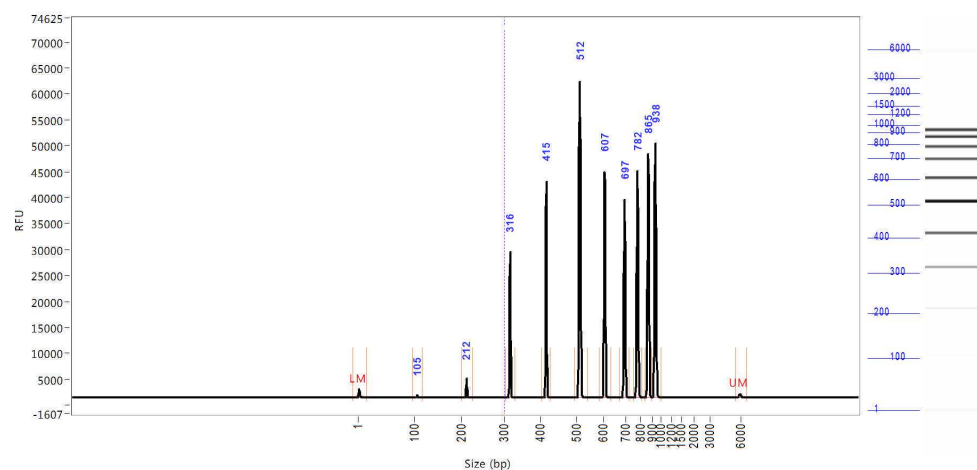
Ratio 0.8:



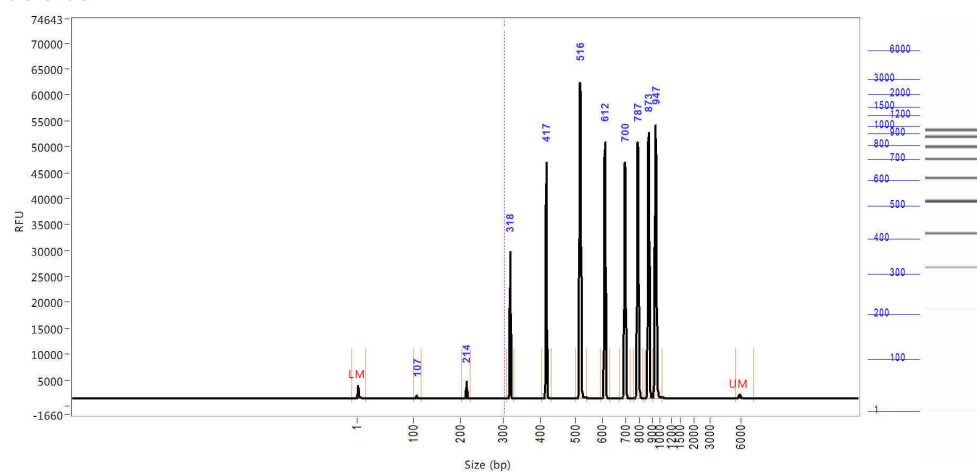
Ratio 0.75:



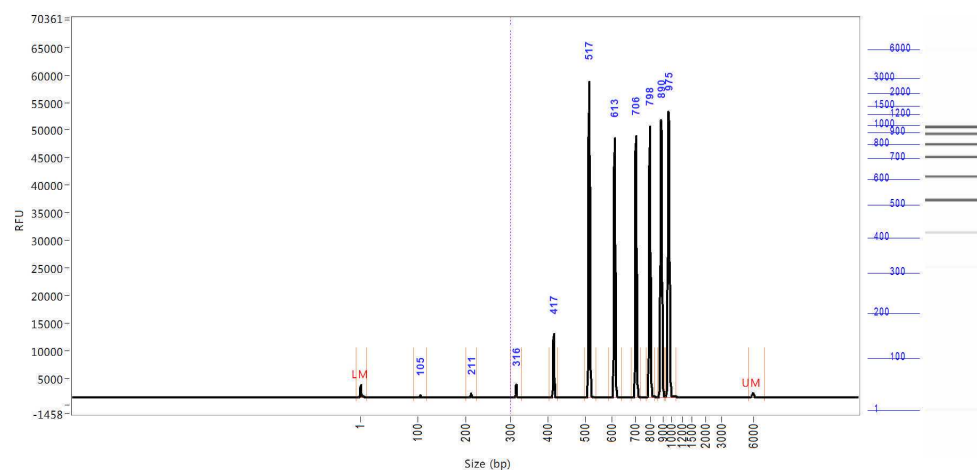
Ratio 0.7:



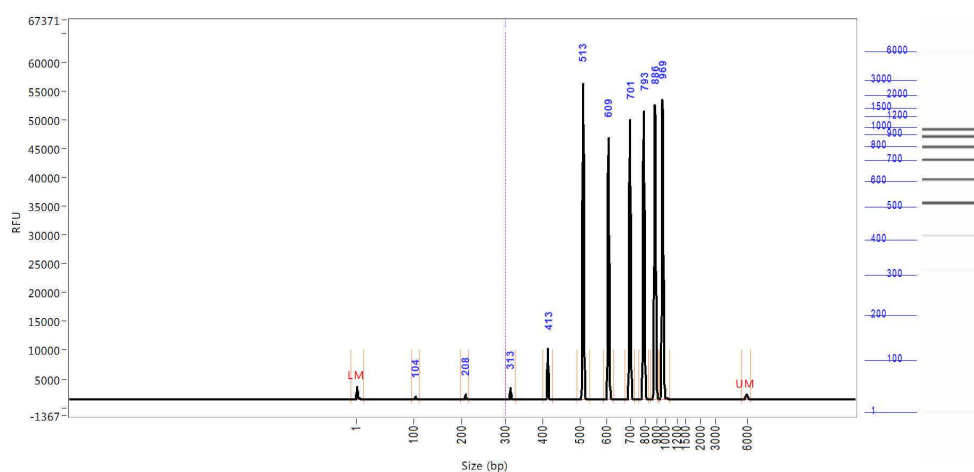
Ratio 0.65:



Ratio 0.6:



Ratio 0.55:



## MATERIALS TEXT

### Materials required:

Below all materials needed for the protocol are listed. Vendors and part numbers are listed but interchangeable depending on the supply situation.

**Chemicals:**

⚗ Ethanol absolute 99.8% Fisher

Ethanol absolute **Scientific Catalog #11994041**

 Hydrochloric acid fuming 37% **Sigma**

Hydrochloric acid fuming 37% **Aldrich Catalog #1003171011**

 Tris ultrapure

Tris ultrapure 99.9% **99.9% Diagonal Catalog #A1086.1000**

EDTA disodium salt **Sigma**

EDTA disodium salt **Aldrich Catalog #E5134-50G**

 **Tween 20** **Carl**

Tween 20 **Roth Catalog #9127.1**

## Sera-Mag SpeedBeads

 Sera-Mag SpeedBeads carboxylate modified particles **Sigma**

Aldrich Catalog #GE45152105050350

PCR-grade water

Invitrogen UltraPure DNase/RNase-Free Distilled Water **Fisher**

Scientific Catalog #11538646

**Labware:**

125 mL Nalgene Wide-Mouth Bottle

 [Thermo Scientific Nalgene Wide-Mouth LDPE Bottle with Closure](#) **Fisher**

**Scientific Catalog #10044180**

 [Neodyme](#)

Large magnet [magnet](#) **Magnethandel Catalog #3935**

 [MM-Seperator M96](#) **Carl**

96-well plate magnet **Roth Catalog #2141.1**

 [Hard-Shell 96-well PCR plate](#) **BioRad**

Hard-Shell PCR Plate **Sciences Catalog #HSP9601**





Clear Polystyrene 96-Well Microplate

 [Corning Clear Polystyrene 96-Well EIA/RIA Microplate](#) **Fisher**





**Scientific Catalog #10380982**

#### Stock solutions:





 **1 L Tris stock solution** [M] **1 Molarity (M)** pH 8.5

- Add  **121.14 g Tris ultrapure 99.9%** to a beaker
- Adjust volume to  **800 mL** with ddH<sub>2</sub>O
- Adjust pH to pH 8.5 with HCl
- Adjust volume to  **1 L** with ddH<sub>2</sub>O
- Sterilize by filtering and store at  **Room temperature**



 **1 L Tris stock solution** [M] **1 Molarity (M)** pH 8

- Add  **121.14 g Tris ultrapure 99.9%** to a beaker
- Adjust volume to  **800 mL** with ddH<sub>2</sub>O
- Adjust pH to pH 8 with HCl
- Adjust volume to  **1 L** with ddH<sub>2</sub>O
- Sterilize by filtering and store at  **Room temperature**

 **1 L Tris stock solution** [M] **1 Molarity (M)** pH 7.5

- Add  **121.14 g Tris ultrapure 99.9%** to a beaker
- Adjust volume to  **800 mL** with ddH<sub>2</sub>O
- Adjust pH to pH 7.5 with HCl
- Adjust volume to  **1 L** with ddH<sub>2</sub>O
- Sterilize by filtering and store at  **Room temperature**

 **1 L EDTA stock solution** [M] **0.5 Molarity (M)** pH 8

- Add  **186.12 g EDTA disodium salt** to a beaker
- Adjust volume to  **1 L** with ddH<sub>2</sub>O
- Adjust pH to pH 8 with sodium hydroxide

- Sterilize by filtering and store at **Room temperature**

#### **1 L wash buffer stock solution** ( **50 millimolar (mM) Tris** ) **pH 7.5**

- Add **50 mL Tris stock solution** **pH 7.5** to a beaker
- Adjust volume to **1 L** with ddH<sub>2</sub>O
- Sterilize by filtering and store at **Room temperature**

#### **1 L PEG-NaCl buffer** ( **2.5 Molarity (M) NaCl** , **20 Mass / % volume PEG 8000** , **10 millimolar (mM) Tris** , **1 millimolar (mM) EDTA** , **0.05 % (v/v) Tween 20** ) **pH 8**

- Add **200 g PEG 8000** to a beaker
- Add **146.2 g NaCl**
- Add **10 mL Tris stock solution** **pH 8**
- Add **2 mL EDTA stock solution** **pH 8**
- Add **250 µL of Tween 20**
- Adjust volume to **1 L** with ddH<sub>2</sub>O
- Dissolve the PEG and NaCl by stirring and heating to **80 °C** the solution will become milky at this point.
- Let the solution cool down to **Room temperature**
- Sterilize by filtering and store at **4 °C**

#### **Working solutions:**

#### **1 L TE minimum buffer** ( **10 millimolar (mM) Tris** , **1 millimolar (mM) EDTA** ) **pH 8**

- Add **10 mL Tris stock solution** **pH 8** to a beaker
- Add **200 µL EDTA stock solution** **pH 8**
- Adjust volume to **1 L** with ddH<sub>2</sub>O
- Sterilize by filtering and store at **Room temperature**

#### **1 L wash buffer** ( **10 millimolar (mM) Tris** , **80 % (v/v) Ethanol** ) **pH 7.5**









- Add **200 mL wash buffer stock solution**
- Adjust volume to **1 L with Ethanol absolute**
- Sterilize by filtering and store at **Room temperature**

#### **1 L elution buffer** ( **10 millimolar (mM) Tris** ) **pH 8.5**

- Add **10 mL Tris stock solution** **pH 8.5** to a beaker
- Adjust volume to **1 L** with ddH<sub>2</sub>O
- Sterilize by filtering and store at **Room temperature**

#### **100 mL cleanup solution** **pH 8**



- Add  **2 mL Sera-Mag SpeedBeads carboxylate modified** to a clean  **125 mL** Nalgene bottle
- Add  **25 mL TE minimum buffer**
- Shake the bottle to wash the beads
- Place the bottle on a large magnet for  **00:05:00** to pellet the beads
- Discard the supernatant
- Add  **25 mL TE minimum buffer**
- Shake the bottle to wash the beads
- Place the bottle on a large magnet for  **00:05:00** to pellet the beads
- Discard the supernatant
- Add  **100 mL PEG-NaCl buffer**
- Shake well to resuspend the beads
- Store at  **4 °C**


#### SAFETY WARNINGS

Reagents are potentially damaging to the environment. Dispose waste responsibly.

#### BEFORE STARTING

Make sure all buffers are prepared before starting.

For easier pipetting let the bead-solution adjust to  **Room temperature**

The protocol described here is designed for the use of  **250 µL U-bottom assay plates** but can also be done in tubes, PCR plates, strips, or any sufficient reaction vessel. The recommended shaking speeds are adjusted to the plates mentioned in the materials.

- 1 Shake the **cleanup solution** until the beads are homogeneously resuspended

The protocol described here uses a **cleanup solution** to **sample** ratio of 0.8:1. This is sufficient for the removal of primer and primer dimers below a size of 200 bp. For the removal of shorter or larger fragments, the ratio has to be adjusted accordingly. For more information on ratios refer to the

material provided in the tab "Guidelines".

- 2 Add **30 µL PCR-grade water** and **32 µL of cleanup solution** to a **250 µL** U-bottom assay plate

It's recommended to increase the volume of the sample with PCR-grade water for easier liquid handling but also to lower relative pipetting error (e.g. if the pipette is off by **2 µL** the effect on the ratio is larger if working with a **10 µL** assay than when working with a **80 µL** assay.

The amount of beads is calculated as follows:  
(sample volume + water volume) \* ratio = cleanup solution volume

In this example:

(**10 µL PCR product** + **30 µL PCR-grade water**) \* 0.8 = **32 µL cleanup solution**

For higher sample numbers PCR-grade water and cleanup solution can be prepared as a master mix.

- 3 Add **10 µL** of sample.

This protocol works for the cleanup of PCR products as well as the cleanup of DNA extracts or for buffer exchange after enzyme treatment of samples.











- 4 To bind the DNA to the beads shake at **900 rpm, Room temperature , 00:05:00**


If the protocol is not done in plates mixing can also be accomplished by pipetting or vortexing.

- 5 Place the plate on a magnet to pellet the beads for **00:02:00**

2m

Depending on the magnet and volume used separation times may vary and have to be adjusted accordingly.

- 
- 6 Discard the supernatant by pipetting
  - 7 With the plate still on the magnet, add  **100 µL of wash buffer** to each sample
  - 8 Incubate for at least  **00:00:30** 30s
  - 9 Discard the supernatant by pipetting
  - 10  **and repeat once for a total of 2 washes**
  - 11 With the plate still on the magnet, incubate the plate for  **00:05:00** at  **Room temperature** to dry off <sup>5m</sup> residuals of wash buffer
  - 12 Add  **40 µL of elution buffer** to each sample
  - 13  **900 rpm, Room temperature , 00:05:00 to elute the DNA from the beads**
  - 14 Place the plate on a magnet to pellet the beads for  **00:02:00** 2m
  - 15 Transfer  **30 µL** of the DNA to a new PCR plate. Store at  **-20 °C**

Leaving  **10 µL** of elution buffer is recommended to avoid carry-over of beads. If all of the DNA is needed for subsequent analysis try to pipette slowly without disturbing the pellet.

