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Supplementary Protocol

DNeasy® PowerSoil® Pro Kit

For the purification of Low-Biomass DNA using the QIAamp® Ultra Clean Production (UCP) MinElute® Spin Columns

Introduction

The described support protocol leverages the high-performance characteristics of QIAamp's UCP MinElute spin columns (cat. no. 79500), offered as standalone items for integration with the DNeasy PowerSoil Pro Kit (cat. no. 47014 or 47016).

This combined solution is specifically optimized for the extraction and purification of nucleic acids from low-biomass samples—a major technical bottleneck in applications such as whole-metagenome sequencing (WMS) of microbiomes in ultra-clean or contamination-sensitive environments.

The QIAamp UCP MinElute spin columns are manufactured under ultra-clean production conditions and undergo a proprietary decontamination process to remove residual nucleic acids (DNA and RNA), resulting in high-purity columns with minimal background.

These features ensure enhanced specificity and low interference in downstream molecular applications, including PCR and sequencing. The columns are also compatible with both manual and automated workflows, adding to their versatility across a range of sample types (e.g., blood, tissue, and cells).

In the optimized protocol, the standard silica spin columns from the DNeasy PowerSoil Pro Kit are replaced with QIAamp UCP MinElute columns, allowing flexible elution in volumes as low as 20 µL. This reduced elution volume significantly increases the DNA concentration in the final eluate—an essential improvement for successful WMS workflows from surface swabs and other low-biomass samples. These samples are often collected from high-sensitivity environments such as hospitals, food-processing facilities, space exploration equipment, or transport devices during pandemics or outbreaks.

The protocol involves two critical wash steps to remove proteins, salts, humic acids, and other contaminants, while ensuring efficient DNA binding to the silica membrane.

Final elution in a low-volume buffer facilitates complete DNA recovery and optimal yield for downstream applications. This tailored protocol addresses a key limitation in environmental microbiome research—the difficulty of recovering sufficient high-quality DNA from clean or low-biomass surfaces—and enables robust taxonomic and functional characterization of microbial communities via WMS. The combination of the UCP technology with the DNeasy PowerSoil Pro Kit is a powerful tool for environmental monitoring programs and contamination control studies in highly regulated or sterile settings.

Important: Please read the *DNeasy PowerSoil Pro Kit Handbook*, paying careful attention to the "Safety Information" and "Important Notes" sections, before beginning this procedure. The DNeasy PowerSoil Pro Kit is intended for research use only. No claim or representation is intended to provide information for the diagnosis, prevention, or treatment of a disease.

Equipment and Reagents to be Supplied by User

- DNeasy PowerSoil Pro Kit
- QIAamp UCP MinElute Spin Columns
- Isopropanol
- 96–100% Ethanol
- Swabs containing sample material

Notes before starting

- Store the QIAamp UCP MinElute Spin Columns and Buffer CD2 at 4°C.
- Ensure that the PowerBead Pro Tubes rotate freely in the centrifuge without rubbing.
- If Solution CD3 has precipitated, heat at 60°C until precipitate dissolves.
- Perform all centrifugation steps at room temperature (15–25°C).

Procedure

1. Prepare Low-Biomass Wash Buffer C5:
    - N = number of samples to be processed
    - Mix: N*(500 µL C5 + 333 µL EtOH [96–100%])
2. Spin the PowerBead Pro Tube briefly to ensure that the beads have settled at the bottom.
3. After swabbing the respective surface or sample material, transfer the swab head directly to the prepared Power Bead Tubes. Add 800 µL CD1 Vortex briefly to mix.
4. Secure the PowerBead Pro Tube horizontally on a Vortex Adapter for 1.5–2 mL tubes (cat. no. 13000-V1-24). Vortex at maximum speed for 10 min.

    Note: If using the Vortex Adapter for more than 12 preps simultaneously, increase the vortexing time by 5–10 min.

    Note: For more information about other bead beating methods, see the "Protocol: Detailed" section of *DNeasy PowerSoil Pro Kit Handbook*.
5. Centrifuge the PowerBead Pro Tube at 15,000 x *g* for 1 min.
6. Transfer the supernatant to a clean 2 mL microcentrifuge tube.

    Note: Expect 500–600 µL. The supernatant may still contain some particles.
7. Add 200 µL of Solution CD2 and vortex for 5 s.
8. Centrifuge at 15,000 x *g* for 1 min at room temperature. Avoiding the pellet, transfer up to 700 µL of supernatant to a clean 2 mL microcentrifuge tube.

    Note: Expect 500–600 µL.
9. Add 600 µL of Solution CD3 + 600 µL 100% Isopropanol and vortex for 5 s.
10. Load 650 µL of the lysate into the QIAamp UCP MinElute spin column and centrifuge at 15,000 x *g* for 1 min.

11. Discard the flow-through and repeat step 8 until all of the lysate has passed through the QIAamp UCP MinElute spin column.
12. Carefully place the QIAamp UCP MinElute spin column into a clean 2 mL collection tube. Avoid splashing any flow-through onto the spin column.
13. Add 500 µL of Solution EA to the QIAamp UCP MinElute spin column. Centrifuge at 15,000 x *g* for 1 min.
14. Discard the flow-through and place the QIAamp UCP MinElute spin column back into the same 2 mL collection tube.
15. Add 500 µL of the previously prepared Low-Biomass Wash Buffer C5 to the QIAamp UCP MinElute spin column. Centrifuge at 15,000 x *g* for 1 min.
16. Discard the flow-through and place the QIAamp UCP MinElute spin column into a new 2 mL collection tube.
17. Centrifuge at up to 16,000 x *g* for 2 min. Carefully place the QIAamp UCP MinElute spin column into an elution tube (1.5 mL).
18. Add 20 µL of Solution C6 to the center of the white filter membrane.
19. Centrifuge at 15,000 x *g* for 1 min. Discard the QIAamp UCP MinElute spin column. The DNA is now ready for downstream applications.

    Note: We recommend storing the DNA frozen (–30 to –15°C or –90 to –65°C) as Solution C6 does not contain EDTA. To concentrate the DNA, please refer to the "Troubleshooting Guide" of the *DNeasy PowerSoil Pro Kit Handbook*.

Document Revision History

Date	Description
07/2025	Initial release