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Introduction

The E.Z.N.A.® Plant DNA Mini Kit allows rapid and reliable isolation of high-quality total cellular DNA from a wide variety of plant species and tissues. Up to 200 mg of wet tissue (or 50 mg dry tissue) can be processed in less than 1 hour. The system combines the reversible nucleic acid-binding properties of Omega Bio-Tek's HiBind® matrix with the speed and versatility of spin column technology to eliminate polysaccharides, phenolic compounds, and enzyme inhibitors from plant tissue lysates. Purified DNA is suitable for PCR, restriction digestion, and hybridization techniques. There are no organic extractions thus reducing plastic waste and hands-on time to allow multiple samples to be processed in parallel.

If using the E.Z.N.A.® Plant DNA Mini Kit for the first time, please read this booklet to become familiar with the procedure and its various modifications. Dry or fresh plant tissue is disrupted and then lysed in a specially formulated buffer containing detergent. Proteins, polysaccharides, and cellular debris are subsequently precipitated. Contaminants are further removed by isopropanol precipitation of DNA. Binding conditions are then adjusted and the sample is applied to a HiBind® DNA spin-column. Two rapid wash steps remove trace contaminants such as residual polysaccharides and pure DNA is eluted in water or low ionic strength buffer. Purified DNA can be directly used in downstream applications without the need for further purification.

Storage and Stability

All components of the E.Z.N.A.® Plant DNA Mini Kit, except the RNase A are stable for at least 24 months from the date of purchase when stored at 22°C-25°C. Store RNase A at -20°C. During shipment, or storage in cool ambient conditions, precipitates may form in Buffer P3. It is possible to dissolve such deposits by warming the solution at 37°C and gently shaking container.

Binding Capacity

Each HiBind® DNA Mini column can bind approximately 100 µg genomic DNA. Using greater than 200 mg is not recommended.

Kit Contents

Product Number	D3485-00	D3485-01	D3485-02
HiBind® DNA Mini columns	5	50	200
2 ml Collection Tubes	10	100	400
Buffer P1	5 ml	50 ml	180 ml
Buffer P2	1ml	10 ml	40 ml
Buffer P3	2 ml	10 ml	40 ml
RNase A	40 µl	250 µl	1 ml
Elution Buffer	1.5 ml	15 ml	50 ml
DNA Wash Buffer Concentrate	2 ml	20 ml	3 x 20 ml
Instruction Booklet	1	1	1

Before Starting

- Please read the entire booklet to become familiar with the E.Z.N.A.® Plant DNA Mini Kit procedures.
- Dilute DNA Wash Buffer Concentrate with ethanol as follows and **store at room temperature**.

D3485-00	Add 8 ml absolute (96%-100%) ethanol.
D3485-01	Add 80 ml absolute (96%-100%) ethanol.
D3485-02	Add 80 ml absolute (96%-100%) ethanol to each bottle.

- Choose the most appropriate protocol to follow. Procedures are described for each of dried and fresh (or frozen) specimens. In addition, a short protocol is given for isolation of DNA for PCR reactions.

A. Dry Specimens	For processing ≤ 50 mg powdered tissue. Yield is sufficient for several tracks on Southern assay.
B. Fresh/Frozen Specimens	For processing ≤ 200 mg fresh (or frozen) tissue. Yield is similar to A.
C. Short protocol	Rapid protocol for dried or fresh samples. Yield is sufficient for PCR.

A. E.Z.N.A.™ Plant DNA Mini Protocol for Dry Specimens

Materials to be provided by user:

- Micro-centrifuge capable of at least 10,000 x g
- Nuclease-free 1.5 ml or 2 ml microfuge tubes
- Waterbath equilibrated to 65°C
- Sterile deionized water equilibrated at 65°C
- Isopropyl alcohol (isopropanol)
- Absolute (96%-100%) ethanol
- Paper towels

This is the most robust method for isolation of total cellular (mitochondrial, chloroplast, and genomic) DNA. Yields are usually sufficient for several tracks on a Southern blot for RFLP mapping.

Drying allows storage of field specimens for prolonged periods of time prior to processing. Samples can be dried overnight in a 45°C oven, powdered, and stored dry at room temperature. To prepare dried samples place up to 50 mg of dried tissue into a microfuge tube (2 ml tubes are recommended for processing of >50 mg tissue) and grind using a pellet pestle. Disposable Kontes pestles work well and are available from Omega Bio-Tek (Cat# SSI-1014-39 & SSI-1015-39). For critical work such as PCR and cloning, pestles are best used a single time then soaked in a dilute bleach solution immediately after use until clean. Disposable pestles may be autoclaved several times. For standard Southern analysis, the same pestle can be reused several times to grind multiple tissue samples by rinsing with ethanol and wiping the surface clean between samples. A fine powder will ensure optimal DNA extraction and yield. Process in sets of four to six tubes until Step 2 before starting another set.

1. **To 10-50 mg powdered dry tissue add 800 µl Buffer P1.** Vortex vigorously to mix well. Make sure to disperse all clumps.

TIP: Process in sets of four to six tubes: grind, add Buffer P1 and proceed to Step 2 before starting another set. Do not exceed 50 mg dried tissue.

2. **Incubate at 65°C for 10 min. Mix sample twice during incubation by inverting tube.**
3. **Add 140 µl Buffer P2 and vortex to mix. Centrifuge at $\geq 10,000 \times g$ for 10 min. Carefully aspirate supernatant to a new microfuge tube, making sure not to disturb the pellet or transfer any debris.**

4. **Add 0.7 volume isopropanol and vortex to precipitate DNA.** This step will remove much of the polysaccharides and improves spin-column performance by increasing DNA binding capacity (and hence yield) in the steps that follow. No incubation is required after addition of isopropanol.

TIP: In most cases 700 µl supernatant can easily be removed. This will require 490 µl isopropanol. Note that depending on the sample, the volume of supernatant may vary. After transferring to a fresh tube, measure the volume and add the correct amount of isopropanol.

5. **Immediately centrifuge at 10,000 x g for 2 min to pellet DNA.** Longer centrifugation does not improve yields.
6. **Carefully aspirate or decant the supernatant and discard making sure not to dislodge the DNA pellet.** Invert the microfuge tube on a paper towel for 1 min to allow residual liquid to drain. It is not necessary to dry the DNA pellet.
7. **Add 300 µl of sterile deionized water pre-heated to 65°C and vortex to resuspend the pellet.** A brief incubation at 65°C may be necessary to effectively dissolve the DNA. Add 4 µl RNase A and mix. No additional incubation is required for RNase treatment.

TIPS: 1. While incubating at 65°C to dissolve the DNA, label and place the required number of HiBind® DNA columns in 2 ml collection tubes. 2. RNase A can be added to sterile deionized water (in proper proportion) to simplify the procedure. The RNase A will remain stable during incubation.

8. **Adjust binding conditions of the sample by adding 150 µl Buffer P3 followed by 300µl absolute ethanol and vortex to obtain a homogeneous mixture.** A precipitate may form upon addition of ethanol; it will not interfere with DNA isolation.

Note: A 1:2 ratio mixture of Buffer P3/absolute ethanol can be made before beginning the procedure. Keep bottle tightly cap when not in use.

9. **Apply the entire sample (including any precipitate that may have formed) to a HiBind® DNA Mini column placed in a 2 ml collection tube (supplied) .** Centrifuge the column at 10,000 x g for 1 min to bind DNA. Discard both the 2 ml collection tube and the flow-through liquid. Note: This is the point to start the optional vacuum/spin protocol. (See page 10 for details)
10. **Transfer column to a second collection tube and wash by adding 650 µl DNA Wash Buffer diluted with absolute (96%-100%) ethanol.** Centrifuge at 10,000 x g for 1 min and discard the flow-through liquid. Reuse the collection tube in Step 11 below. **NOTE:** DNA Wash Buffer Concentrate must be diluted with absolute (96%-100%) ethanol prior to use. Follow directions on label.
11. **Repeat wash step with an additional 650 µl DNA wash Buffer.** Centrifuge at 10,000 x g for 1 min. Discard flow-through and reuse 2 ml collection tube in Step 12.
12. **Centrifuge the empty column 2 min at maximum speed (no more than 20,000 x g) to dry.** This step is critical for removing residual ethanol that may otherwise be eluted with DNA and interfere with downstream applications.
13. **Transfer the column to a clean 1.5 ml tube. Apply 100 µl Elution Buffer (or 10 mM Tris buffer pH 8.5/9.0 or sterile deionized water) pre-**

warmed to 65°C and incubate at room temperature for 3 to 5 min. Centrifuge at 10,000 x g for 1 min to elute DNA. Smaller volumes will significantly increase DNA concentration but give lower yields. Use of more than 200 µl of buffer for elution is not recommended.

14. **Repeat Step 13 with an additional 100 µl of buffer.** This may be performed using another 1.5 ml tube to maintain a higher DNA concentration in the first eluate.

TIP: To increase DNA concentration add buffer and incubate the column at 65°C for 5 min before elution. Alternatively, first eluate can be used for a second elution.

Total DNA yields vary according to type and amount of sample. Typically, 10-50 µg DNA with a A_{260}/A_{280} ratio of 1.7-1.9 can be isolated using 50 mg dried tissue.

B. E.Z.N.A.™ Plant DNA Mini Protocol For Fresh/Frozen Specimens

Materials to be provided by user:

- Microcentrifuge capable of 10,000 x g
- Nuclease-free microfuge tubes
- Water bath equilibrated to 65°C
- Sterile deionized water equilibrated at 65°C
- Absolute (96%-100%) ethanol
- Isopropyl alcohol (isopropanol)
- Paper towels
- Liquid nitrogen for freezing/disrupting samples

NOTE: Use extreme caution when handling liquid nitrogen.

This protocol is suitable for most fresh or frozen tissue samples allowing more efficient recovery of DNA. However, due to the tremendous variation in water and polysaccharide content of plants, sample size should be limited to ≤ 200 mg. Best results are obtained with young leaves or needles. The method isolates sufficient DNA for several tracks on a standard Southern assay.

To prepare samples collect tissue in a 1.5 ml or 2 ml microfuge tube and freeze by dipping in liquid nitrogen with a pair of tweezers to fill the tube. Grind the tissue using disposable Kontes pellet pestles, which are available from VWR (Cat# KT749521-0500). Alternatively, one can allow liquid nitrogen to evaporate and then store samples at -70°C for later use. For critical work such as PCR and cloning, pestles are best used a single time then soaked in a dilute bleach solution immediately after use until cleaning. Disposable pestles may be autoclaved several times. For standard Southern analysis, the same pestle can be reused several times to grind multiple tissue samples by rinsing with ethanol and carefully wiping the surfaces clean between samples.

1. **Collect ground plant tissue (start with 100 mg) in a microfuge tube and immediately add 600 µl Buffer P1.** Vortex vigorously to mix. Make sure to disperse all clumps. DNA cannot be effectively extracted from clumped tissue.

TIP: Process in sets of four to six tubes: fill all tubes with liquid nitrogen, grind, add Buffer P1 and proceed to Step 2 before starting another set. As a starting point use 100 mg tissue per tube and if yield and purity are satisfactory increase to 200 mg.

2. **Incubate at 65°C for 10 min. Mix sample twice during incubation by inverting tube.**
3. **Add 140 µl Buffer P2 and vortex to mix. Centrifuge at $\geq 10,000 \times g$ for 10 min. Carefully aspirate cleared lysate to a new microfuge tube making sure not to disturb the pellet or transfer any debris.**

4. **Add 0.7 volume isopropanol and vortex to precipitate DNA.** This step will remove much of the polysaccharides and improves spin-column performance by increasing DNA binding capacity (and hence yield) in the steps that follow. No incubation is required after addition of isopropanol.

TIP: In most cases 600 µl supernatant can easily be removed. This will require 420 µl isopropanol. Note that depending on the sample, the volume of supernatant may vary. After transferring to a fresh tube, measure the volume and add the correct amount of isopropanol.

5. **Immediately centrifuge at 10,000 x g for 2 min to pellet DNA.** Longer centrifugation does not improve yields.
6. **Carefully aspirate or decant the supernatant and discard making sure not to dislodge the DNA pellet.** Invert the microfuge tube on a paper towel for 1 min to allow residual liquid to drain. It is not necessary to dry the DNA pellet.
7. **Add 300 µl of sterile deionized water pre-heated to 65°C and vortex to resuspend the pellet.** A brief incubation at 65°C may be necessary to effectively dissolve the DNA. Add 4 µl RNase and mix. No additional incubation is required for RNase treatment.
8. **Adjust binding conditions of the sample by adding 150 µl Buffer P3 followed by 300 µl absolute ethanol and vortex to obtain a homogeneous mixture.** A precipitate may form upon addition of ethanol; it will not interfere with DNA isolation.

TIPS: 1. While incubating at 65°C to dissolve the DNA, label and place the required number of HiBind® DNA columns in 2 ml collection tubes. 2. RNase A can be added to sterile deionized water (in proper proportion) to simplify the procedure. The RNase A will remain stable during incubation.

9. **Apply the entire sample (including any precipitate that may have formed) to a HiBind® DNA column placed in a 2 ml collection tube**

(supplied) . Centrifuge the column at 10,000 x g for 1 min to bind DNA. Discard both the 2 ml collection tube and the flow-through liquid.

Note: This is the point to start the optional vacuum/spin protocol. (See Page 10 for details.)

10. **Transfer column to a second collection tube and wash by adding 650 µl Wash Buffer diluted with absolute (96%-100%) ethanol.** Centrifuge at 10,000 x g for 1 min and discard the flow-through liquid. Reuse the collection tube in Step 11 below.

NOTE: DNA Wash Buffer Concentrate must be diluted with absolute (96%-100%) ethanol prior to use. Follow directions on label.

11. **Repeat wash step with an additional 650 µl DNA wash Buffer.** Centrifuge at 10,000 x g for 1 min. Discard flow-through and reuse 2 ml collection tube in Step 12.

12. **Centrifuge empty column 2 min at maximum speed to dry.** This step is critical for removing residual ethanol that may otherwise be eluted with DNA and interfere with downstream applications.

13. **Transfer column to a clean 1.5 ml tube. Apply 100 µl Elution Buffer (or 10 mM Tris buffer pH 8.5/9.0 or sterile deionized water) pre-warmed to 65°C and incubate at room temperature for 3 to 5 min. Centrifuge at 10,000 x g for 1 min to elute DNA.** Smaller volumes will significantly increase DNA concentration but give lower yields. Use of more than 200 µl of buffer for elution is not recommended.

14. **Repeat Step 13 with an additional 100 µl of Elution buffer.** This may be performed using another 1.5 ml tube to maintain a higher DNA concentration in the first eluate.

15. **TIP:** To increase DNA concentration add buffer and incubate the column at 65°C for 5 min before elution. Alternatively, first eluate can be used for a second elution.

Total DNA yields vary according to type and amount of sample. Typically, 20-50 µg DNA with a A_{260}/A_{280} ratio of 1.7-1.9 can be isolated using 200 mg fresh leaf tissue.

C. E.Z.N.A.™ Plant DNA Mini Short Protocol

This simplified method allows rapid isolation of DNA from fresh, frozen, or dried specimens for use in PCR reactions. The procedure limits the amount of starting material, so that DNA yields will generally be lower than those obtained with protocols A and B. Thus in most cases there may not be sufficient material for Southern analysis or cloning work.

Materials to be provided by user:

- Microcentrifuge capable of 10,000 x g
- Nuclease-free microfuge tubes
- Waterbath equilibrated to 65°C
- Absolute (96%-100%) ethanol
- Liquid nitrogen for freezing/disrupting fresh samples

Follow suggestions for preparation of dried or fresh samples as outlined in Sections A and B (pages 4 and 6 respectively). Note the following limitations on sample size:

- **Dry Samples - use a maximum of 10 mg ground tissue**
- **Fresh Samples - use a maximum of 40 mg fresh/frozen ground tissue**

1. **Collect ground sample in a microfuge tube and add 600 µl Buffer P1 and 4 µl RNase A.** Vortex vigorously to mix and incubate at room temperature for 1 min.
2. **Incubate at 65°C for at least 5 min.** Mix sample once during incubation by inverting tube.
3. **Add 140 µl Buffer P2 and vortex to mix. Centrifuge at $\geq 10,000$ x g for 10 min.**
4. **Carefully aspirate 600 µl supernatant to a new microfuge tube making sure not to disturb the pellet or transfer any debris. Add 0.5 volume of Buffer P3 and one volume of absolute ethanol.** Vortex thoroughly to obtain a homogeneous mixture. A precipitate may form but will not affect the procedure.

TIP: Volume of supernatant will vary, and is usually lower with dried samples. For 600 µl of supernatant add 300 µl Buffer P3 followed by 600 µl absolute ethanol.
5. **Apply 750 µl of the mixture to a HiBind® DNA column assembled in a 2ml collection tube (supplied).** Centrifuge at 10,000 x g for 1 min to bind DNA. Discard flow-through liquid and reuse collection tube in the next step.
6. **Add the remainder of the sample (including any precipitate that may have formed) to the column.** Centrifuge at 10,000 x g for 1 min and discard both the 2 ml collection tube and the flow-through liquid.

7. Place the column in a second 2ml tube and add 650 µl DNA wash Buffer diluted with absolute ethanol. Centrifuge at 10,000 x g for 1 min and discard flow-through liquid. Keep 2 ml tube.
8. **Repeat wash step with an additional 650 µl DNA wash Buffer.** Centrifuge at 10,000 x g for 1 min. Discard flow-through and reuse 2 ml collection tube in Step 9.
9. **Centrifuge empty column 2 min at maximum speed to dry.** This step is critical for removing residual ethanol that may otherwise be eluted with DNA and interfere with downstream applications.
10. **Transfer column to a clean 1.5 ml tube. Add 100 µl Elution Buffer (or 10 mM Tris buffer pH 8.5/9.0 or sterile deionized water) pre-warmed to 65°C and incubate at room temperature for 3 to 5 min. Centrifuge at 10,000 x g for 1 min to elute DNA.** Smaller volumes will significantly increase DNA concentration but give lower yields. Use of more than 200 µl of buffer for elution is not recommended.
11. **Repeat Step 10 with an additional 100 µl of buffer.** This may be performed using another 1.5 ml tube to maintain a higher DNA concentration in the first eluate.

TIP: To increase DNA concentration add buffer and incubate the column at 65°C for 5 min before elution. Alternatively, first eluate can be used for second elution.

Yields vary according to sample size and whether dried or fresh. Between 2 µg-10 µg restrictable DNA can usually be obtained with this method.

Vacuum/Spin Protocol (V-Spin Column Only)

Note: Please read through previous sections of this manual before using this protocol.

1. Prepare wet or dry samples by following the standard Protocol in previous sections until loading DNA/P3/Ethanol mixture to a HiBind® DNA column.
2. Prepare the vacuum manifold according to manufacturer's instructions and connect the V-Spin column to the manifold.
3. Load the DNA/P3/Ethanol solution to the column.
4. Switch on vacuum source to draw the sample through the column; then turn off the vacuum.
5. Wash the column by adding 650 µl DNA wash Buffer. Draw the wash buffer through the column by turning on the vacuum source. Repeat this step with another 650 µl DNA wash Buffer.
6. **Assemble the column into a 2 ml collection tube and transfer the column to a micro centrifuge. Spin 1 minute to dry the column.**
7. Place the column in a clean 1.5 ml microcentrifuge tube and add 30-50µl Elution Buffer. Stand for 1-2 min and centrifuge 1 min to elute DNA.

Troubleshooting Guide

Problem	Cause	Suggestions
Clogged column	Carry-over of debris.	Following precipitation with Buffer P2, make sure no particulate material is transferred.
	DNA pellet not completely dissolved before applying sample to column.	In protocols A and B, ensure that DNA is dissolved in water before adding Buffer P3 and ethanol. This may need repeated incubation at 65°C and vortexing.
	Sample too viscous.	In protocol C, do not exceed suggested amount of starting material. Alternatively, increase amounts of Buffers P1 and P2 and use two or more columns per sample.
	Incomplete precipitation following addition of P2.	Increase RCF or time of centrifugation after addition of Buffer P2.
Low DNA yield	Incomplete disruption of starting material.	For both dry and fresh samples, obtain a fine homogeneous powder before adding Buffer P1.
	Poor lysis of tissue.	Decrease amount of starting material or increase amount of Buffers P1 and P2.
	DNA remains bound to column.	Increase elution volume to 200 µl and incubate on column at 65°C for 5 min before centrifugation.
	DNA washed off.	Dilute Wash Buffer Concentrate by adding appropriate volume of absolute ethanol prior to use (Page 3).
Problems in downstream applications	Salt carry-over.	Wash Buffer must be at room temperature.
	Ethanol carry-over	Following the second wash spin, ensure that the column is dried by centrifuging 2 min at maximum speed.

Related Products

Product No.	Product Name	Description
Plant DNA and Plant RNA Isolation Kits		
D3485-01/02 D3486-01/02	Plant DNA Mini Kit	Isolation of total cellular DNA from dry and wet plant samples
D3487-01/02	Plant DNA Midi Kit	Isolation of total cellular DNA from up to 500 mg plant samples
D3488-01/02	Plant DNA Maxi Kit	Isolation of total cellular DNA from up to 2 g dry and wet plant samples
D1086-01/02	E-Z 96 Plant DNA Isolation Kit	Isolation of total cellular DNA from dry and wet plant samples in a 96-well format
R6627-01/02 R6827-01/02	Plant RNA Kit	Isolate total cellular RNA from plant samples
R6628-01/02	Plant RNA Midi Kit	Isolate up to 800ug total cellular RNA from plant samples

For technical support or to place orders, contact Omega Bio-Tek:

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