User Guide

Immobilon®-P Transfer Membrane

For High Sensitivity Immunodetection

Introduction

Immobilon®-P transfer membrane is a polyvinylidene fluoride (PVDF) microporous membrane used for transfer of proteins from a variety of gel matrices. This membrane is hydrophobic and offers a uniformly controlled pore structure with a high binding capacity for biomolecules. When compared to a nitrocellulose membrane, it has improved handling characteristics and staining capabilities, increased solvent resistance, and a higher signal-to-noise ratio for enhanced sensitivities.

The Immobilon®-P membrane has a nominal pore size of 0.45 micron (µm) and is optimal for blotting proteins with molecular weights greater than 20 kilodaltons (kDa). Immobilon®-P^{SQ} membrane is optimal for proteins less than 20 kDa. It is an ideal substrate for immunodetection, since it is compatible with standard blocking agents and detection protocols, including chemiluminescence. Because the membrane is composed of PVDF, it is also compatible with the harsh conditions used in protein sequencing and amino acid analysis. This user guide provides basic protocols for electroblotting and rapid immunodetection.

Table 1. Immobilon®-P Membrane Properties and Applications

Composition	**PVDF**
Pore size	0.45 µm
Phobicity	Hydrophobic
Protein binding capacity	Insulin: 160 µg/cm^2 Bovine serum albumin (BSA): 215 µg/cm^2 Goat IgG: 294 µg/cm^2
Applications	Binding assays Dot/slot blotting Glycoprotein visualization Lipopolysaccharide analysis Mass spectrometry Amino acid analysis N- terminal protein sequencing
Detection methods*	Chemiluminescent (Immobilon® HRP substrates) Chromogenic (TMB, Insoluble)

*For fluorescence detection methods, low-autofluorescent Immobilon®-FL membrane is recommended.

Protein visualization methods

Transillumination	
Reversible Stains	Ponceau-S
Irreversible Stains	Coomassie™ Brilliant Blue dye Amido black India ink Colloidal gold

*For fluorescence detection methods, low-autofluorescent Immobilon®-FL membrane is recommended

Guidelines for Working with Immobilon®-P membrane

- Always wear gloves when handling the membrane, in order to avoid fingerprints.
- Use blunt forceps to prevent membrane damage.
- Keep the Patapar® Paper (blue) with the membrane during cutting or handling, but discard when wetting the membrane.
- Handle with care to avoid scratches on the membrane surface. Do not fold the membrane.
- Hydrophobic Immobilon®-P membrane must be wet in an alcohol solution (>50% v/v methanol, ethanol, or isopropanol) before use. Once the membrane is wet, it changes from opaque to semi-transparent.
- After protein transfer, wash the blot with Milli-Q® water to eliminate any gel residues.
- Blots can be air dried and stored at 4° C for several months (for later use) or they can be used immediately.

Materials Recommended for Western Blotting

- Immobilon®-P membrane cut to the dimensions of the gel.
- Alcohol (>50% methanol, ethanol, or isopropanol) for wetting dry membrane.
- Milli-Q® water.
- Transfer buffer: 25 mM Tris-base, 192 mM glycine, pH 8.3, 10% alcohol for tank transfer or 48 mM Tris, 39 mM glycine, pH 9.2, 10% alcohol for semi-dry transfer.
- Sheets of filter paper, cut to the dimensions of the gel and soaked in transfer buffer for at least 30 seconds.
- Blocking buffer: Block-CH buffer (Cat. No. WBAVDCH01) or 0.5–5% (w/v) blocking agent (bovine serum albumin, casein, nonfat dry milk) in wash buffer.
- Wash buffer: Phosphate-buffered saline (PBS) or Tris-buffered saline (TBS) containing 0.05-0.1% Tween®-20 surfactant (PBST or TBST).
- PBS: 10 mM sodium phosphate, pH 7.2, 0.9% NaCl
  TBS: 10 mM Tris, pH 7.4, 0.9% NaCl.
- Primary antibody (specific for the protein of interest), diluted in blocking buffer or wash buffer.
- Secondary antibody (specific for the primary antibody), labeled with a detection enzyme (e.g., horseradish peroxidase [HRP] or alkaline phosphatase [AP]), diluted in blocking buffer or wash buffer).

Protein Transfer

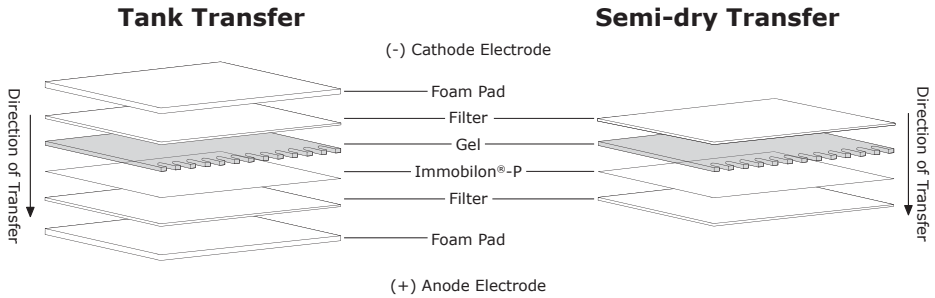
Proteins can be transferred to Immobilon®-P membrane by two common electro-transfer methods: tank and semi-dry transfer. Table 2 describes the general conditions and major differences for the two methods.

1. Resolve the protein mixture on a 1D or 2D polyacrylamide gel.
2. Immerse the gel in the transfer buffer and allow it to equilibrate for 10–15 minutes.
3. Wet the Immobilon®-P membrane in alcohol (>50% methanol, ethanol, or isopropanol) for 10-20 seconds, or until the it changes from opaque white to uniform, translucent gray. Do not leave dry spots, as these may inhibit transfer.
4. Immerse the membrane in Milli-Q® water for 1–2 minutes to displace the alcohol.
5. Equilibrate the membrane for 2–3 minutes in the transfer buffer.

   CAUTION: To prevent tearing, handle the membrane with care. Once the membrane has been wet out, do not allow it to dry out until the proteins have been transferred to it. If the membrane dries out (turns opaque white) even partially, it must be wet out again (steps 3–4).
6. Assemble the transfer stack as shown on the next page or according to transfer apparatus manufacturer's instructions.

   CAUTION: To ensure an even transfer, remove air bubbles by carefully rolling a clean pipette or blot roller over the surface of each layer in the stack. Do not apply excessive pressure, as this may damage the gel and membrane.
7. Transfer proteins according to transfer apparatus manufacturer's instructions.
8. Remove the blot from the transfer system and rinse the membrane briefly in Milli-Q® water to remove gel debris. The blot may be used immediately, or air dried for storage.
9. **Optional:** To visualize all of the transferred proteins, Immobilon®-P membrane may be stained with any reversible blot stain compatible with immunodetection (e.g., Ponceau-S, CPTS, Sypro® Ruby or Sypro® Rose blot stains), or viewed by transillumination using a light box.

Table 2. Transfer Methods



Conditions	Membrane gel stack immersed in buffer	Filter paper soaked in buffer
Buffer volume	0.5 L or higher depending on system	~ 0.05 L per mini-gel
Transfer time	Slow (1 or more hours)	Fast (7–45 minutes)
Typical run	Constant voltage	Constant current
Gel equilibration time	Not necessary but recommended	Minimum of 15 minutes equilibration per mini-gel
Typical continuous buffer name/composition	Towbin buffer, pH 8.3 25 mM Tris, 192 mM glycine	Bjerrum-Shafer-Nielsen buffer, pH 9.2 48 mM Tris, 39 mM glycine
Required buffer system	Continuous (single buffer)	Continuous (single buffer) or Discontinuous (3 buffers)
Typical discontinuous buffer name/composition	N/A	Anode buffer I: 300 mM Tris, pH 10.4 Anode buffer II: 25 mM Tris, pH 10.4 Cathode buffer: 25 mM Tris, 40 mM amino-caproic acid, pH 9.4
% Alcohol*	10–20% alcohol	10–20% alcohol
% SDS*	0.02–0.05% SDS	0.02–0.05% SDS

*Alcohol (methanol, ethanol, or isopropanol) in the transfer buffer has two important functions; it stabilizes the gel dimensions and strips complexed sodium dodecyl sulfate (SDS) from protein molecules, improving protein binding to the membrane. However, for large proteins, or proteins that exhibit solubility problems, it is recommended that the alcohol concentration be decreased and that a small amount of SDS be added to the transfer buffer. This improves protein elution from the gel while maintaining protein solubility during the transfer process.

Immunodetection

Immunodetection is an antibody-based method that allows the detection, identification, and quantitation of a protein or antigen in the blotting membrane. The typical protocol follows these six general steps:

1. Block unoccupied membrane sites to prevent nonspecific binding of antibodies.
2. Incubate the membrane with a primary antibody that binds to the protein of interest.
3. Wash to remove any unbound primary antibody.
4. Incubate the membrane with a conjugated secondary antibody, which binds to the first antibody.
5. Wash to remove any unbound secondary antibody.
6. Incubate the membrane with a substrate that reacts with the conjugated secondary antibody to reveal the location of the protein.

Common Protocols Used in Western Blotting and Immunodetection

Membrane Wetting

1. Wet the dry membrane in alcohol (>50% methanol, ethanol, or isopropanol) for 10–20 seconds, or until it changes from a opaque white to uniform, translucent gray.
2. Immerse the membrane in Milli-Q® water for 1–2 minutes to displace the alcohol.
3. Equilibrate the membrane in transfer buffer for 2–3 minutes or until ready to use.

   CAUTION: Once the membrane has been wet out, do not allow it to dry out. It can be kept in buffer until protein transfer. If the membrane dries out (turns opaque white) even partially, it must be wet out again (steps 1–3).

Semi-dry Transfer

1. Resolve the protein mixture on a 1D or 2D polyacrylamide gel.
2. Immerse the gel in the transfer buffer and allow it to equilibrate for 10–15 minutes.
3. Assemble the transfer stack according to manufacturer's instructions for the transfer.

   CAUTION: To ensure an even transfer, remove air bubbles by carefully rolling a clean pipette or blot roller over the surface of each layer in the stack. Do not apply excessive pressure, as this may damage the gel and membrane.
4. Transfer proteins according to transfer apparatus manufacturer's instructions.
5. Remove the blot from the transfer system and rinse the membrane briefly in Milli-Q® water to remove gel debris. The blot may be air dried for storage, or it can be used immediately for the immunodetection step.

   NOTE: Drying the blot before immunodetection may enhance the binding of some proteins and reduce background noise.

Protein Visualization (Optional)

To visualize the protein transfer efficiency, Immobilon®-P membrane may be stained with any reversible blot stain compatible with immunodetection (e.g., Ponceau-S, toluidine blue, CPTS, Sypro® blot stains) or viewed by transillumination using a light box.

Immunodetection

The following is a general protocol for immunodetection with Immobilon®-P membrane. Some of the critical factors for obtaining a "perfect" Western blot such as protein concentration, blocking solution, and antibody concentration may require optimization.

Standard Immunodetection

1. If the blot was dried, rewet it in alcohol (> 50% methanol, ethanol, or isopropanol) for 15 seconds, or until it changes from opaque white to translucent gray.
2. Rinse the blot in Milli-Q® water for 1 minute.
3. Place the blot in blocking buffer and incubate for 1 hour with gentle agitation. Prepare primary antibody solution in wash or blocking buffer.
4. Place the blot in diluted primary antibody solution and incubate for 1 hour with gentle agitation.
5. Wash the blot with wash buffer 3–5 times for 5 minutes each. Prepare secondary antibody solution in wash or blocking buffer.
6. Place the blot in diluted enzyme-labeled secondary antibody solution and incubate for 1 hour with gentle agitation.
7. Wash the blot with wash buffer 3–5 times for 5 minutes each.
8. If developing with a chromogenic reagent, incubate blot in the developing solution until sufficient signal has been generated for the band of interest. To stop development, transfer the blot to Milli-Q® water or follow the instructions provided with the developing reagent. The developed blot may be dried on filter paper and imaged.
9. If developing with chemiluminescent detection, incubate in developer 1–5 minutes, according to detection reagent manufacturer's instructions, and then expose the blot to X-ray film or acquire image using a digital imaging system.

Guidelines for Choosing an Immobilon® PVDF Membrane

The following table provides general guidelines for choosing the appropriate membrane for a specific post Western Blot application. Due to variations in protein properties such as charge density, conformation, and hydrophobicity, not all proteins behave the same way on a given membrane surface. Experiments with a variety of Immobilon® membranes may be necessary to optimize results for your specific application.

Application After Western Blotting	Membrane of Choice for Most Proteins
General immunodetection	Immobilon®-P or Immobilon®-E
Amino acid analysis	Immobilon®-P
Immunodetection of low molecular weight or low-abundance proteins	Immobilon®-P^{SQ}
Sequencing of low molecular weight or low-abundance proteins	Immobilon®-P^{SQ}
Fluorescence immunodetection and chemifluorescence methods	Immobilon®-FL

Product Ordering

Purchase products online at SigmaAldrich.com/products.

Immobilon®-P Membrane (0.45 µm pore size) for General Western Blotting Applications

Size	Qty/Pk	Catalogue Number
8.5 cm × 1000 cm roll	1	IPVH85R
26.5 cm × 375 cm roll	1	IPVH00010
26.5 cm × 187.5 cm roll	1	IPVH00005
10 cm × 10 cm sheet	10	IPVH10100
9 cm × 12 cm sheet	10	IPVH09120
8.5 cm × 13.5 cm sheet	10	IPVH08130
8 cm × 10 cm sheet	10	IPVH08100
7 cm × 8.4 cm sheet	50	IPVH07850

Immobilon®-P^{SQ} Membrane (0.2 µm pore size) for Blotting Applications of Proteins with Molecular Weights Less than 20 kDa

Size	Qty/Pk	Catalogue Number
8.5 cm × 1000 cm roll	1	ISEQ85R
26.5 cm × 375 cm roll	1	ISEQ00010
26.5 cm × 187.5 cm roll	1	ISEQ00005
9 cm × 12 cm sheet	10	ISEQ09120
8.5 cm × 13.5 cm sheet	10	ISEQ08130
8 cm × 10 cm sheet	10	ISEQ08100
7 cm × 8.4 cm sheet	50	ISEQ07850

Immobilon®-FL Membrane (0.45 µm pore size) for Fluorescence Detection Applications

Size	Qty/Pk	Catalogue Number
8.5 cm × 1000 cm roll	1	IPFL85R
26.5 cm × 375 cm roll	1	IPFL00010
26.5 cm × 187.5 cm roll	1	IPFL00005
10 cm × 10 cm sheet	10	IPFL10100
7 cm × 8.4 cm sheet	10	IPFL07810

Immobilon®-E Membrane (0.45 µm pore size) for General Western Blotting Applications

Size	Qty/Pk	Catalogue Number
8.5 cm × 1000 cm roll	1	IEVH85R
26.5 cm × 187.5 cm roll	1	IEVH00005
7 cm × 8.4 cm sheet	50	IEVH07850

Related Products for General Western Blotting Applications

Description	Catalogue Number
Immobilon® NOW Dispenser for 8.5 cm x 1000 cm rolls	IMDISP
Immobilon® Block - CH (Chemiluminescence Blocker), 500 mL	WBAVDFL01
Immobilon® blotting filter paper, 7 cm × 8.4 cm sheet, 100/pk	IBFP0785C
Immobilon® blotting filter paper, 8.5 cm × 13.5 cm sheet, 100/pk	IBFP0813C
Immobilon® Signal Enhancer for immunodetection, 500 mL	WBSH0500
Immobilon® Western HRP substrate, 100 mL	WBKLS0100
Immunoblot Blocking Reagent, 20 g	20-200
Immobilon® ECL Ultra Western HRP substrate, 100 mL	WBULS0100
Immobilon® Forte Western HRP substrate, 100 mL	WBLUF0100
Immobilon® Crescendo Western HRP substrate, 100 mL	WBLUR0100
Immobilon® Classico Western HRP substrate, 100 mL	WBLUC0100
Immobilon®-GO for Simple Immunodetection	IMGDV010
SNAP i.d.® 2.0 Protein Detection System-Mini	SNAP2MINI
SNAP i.d.® 2.0 Protein Detection System-Midi	SNAP2MIDI
SNAP i.d.® 2.0 Mini Blot Holders (7.5 cm x 8.4 cm)	SNAP2BHMN0100
SNAP i.d.® 2.0 Midi Blot Holders (8.5 cm x 13.5 cm)	SNAP2BHMD0100
Phosphate-buffered saline with 3% nonfat milk, pH 7.4, dry powder	P2194
Phosphate-buffered saline with Tween® 20 surfactant, pH 7.4, tablet	08057
Ponceau S solution, 0.1% (w/v) in 5% acetic acid, 1 L	P7170
Re-Blot™ Plus Strong Antibody Stripping solution, 10X, 50 mL (Chemicon®)	2504
TMB substrate, insoluble (Calbiochem®), 100 mL	613548
Tris-buffered saline with Tween® 20 surfactant, pH 7.6, tablet	91414
Tris-glycine buffer 10X Concentrate, 1 L	T4904-1L

Notice

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