PolySciTech Division of
AKINA, INC.
3495 Kent Avenue
West Lafayette, IN 47906
www.polyscitech.com

PolymBlend® User guide for processing by electrospinning

This guide contains the recommended steps for processing PolymBlend® by electrospinning to obtain high performance nonwoven membranes as well as the thermal wetting protocol to make them hydrophobic membranes.

The recommended concentration is 13% w/w (10 g of PolymBlend® in 67 g of solvent). PolymBlend® is supplied in the form of two components: copolymer A and copolymer B. A 1:1 ratio between these two copolymers is recommended, i.e. for 67 g of solvent we recommend using 5 g of copolymer A and 5 g of copolymer B. This ratio provides a polymer blend containing 41% of hydroxylated monomers.

Copolymer A confers stiffness and hardness, whilst copolymer B provides flexibility and elasticity. Thus, the mechanical properties of the final material can be tuned by changing the ratio between these two copolymers.

The % of hydroxylated monomers can also be tuned by varying the ratio between the two copolymers; see the Technical Data Sheet for the calculation of the amount of hydroxylated monomers.

PolymBlend® can be solubilised in DMF, DMSO, dioxane, NMP and any other solvent of similar polarity. For the electrospinning process we recommend DMF as a solvent.

The addition of HCl to the mixture is recommended to increase the conductivity and to facilitate the electrospinning process.

The solubilization protocol:

1. Weigh the correct amounts of copolymers A and B in an adequate vessel.
2. Add the correct amount of solvent (DMF is the recommended solvent).
3. Use magnetic agitation until complete dissolution of the two copolymers (for 13 % w/w we recommend maintaining the magnetic stirring for 24 h).
4. Add 45 µL HCl (37%) and maintain the magnetic stirring for 1 hour more to be sure that HCl has been totally mixed with the polymer blend.

The electrospinning processing parameters:

1. Put the solution into the electrospinner container.
2. Set the conditions and start the production.

The following tables show the standard conditions for the electrospinning process:

Table 1. Standard parameters of the electrospinning process using a drum collector (30 cm length and 20 cm diameter)

Parameter	Multi-needle head (10 needles)	Simple head (1 needle)
Collector voltage	-9 kV	-2 kV
Injector voltage	+14 kV	+9 kV
Caudal (Q)	5 mL/h	1 mL/h
Drum rotation speed (ω)	500 rpm	500 rpm
Distance injector-collector (δ)	15 cm	26 cm
Temperature (T)	20-25°C	20-25°C
Relative humidity (RH)	25-30%	25-30%

Table 2. Standard parameters for electrospinning using a flat collector

Parameter	Multi-needle head (10 needles)	Simple head (1 needle)
Collector voltage	-9 kV	-2 kV
Injector voltage	+14 kV	+9 kV
Caudal (Q)	5 mL/h	1 mL/h
Distance injector-collector (δ)	15 cm	25 cm
Temperature (T)	20-25°C	20-25°C
Relative humidity (RH)	25-30%	25-30%

The thermal wetting protocol:

The membrane obtained by processing PolymBlend® by electrospinning is hydrophobic. To make it hydrophilic, it must be treated with the following thermal wetting protocol:

1. Cut the membrane to size of the water bath and system used to stretch it.
2. Use something to keep the mat stretched throughout the wetting protocol.
3. Introduce the stretched membrane into a water bath at 43 ºC until complete humectation. The average time for a complete humectation of a 200 µm thickness mat produced by 1:1 ratio between the two copolymers, is 5 hours, approximately.
4. Dry the membrane at room temperature and keep it in a dry, dark place.