

USERGUIDE No. 43

Investigation of the chemical resistance of sealing systems for PCR Plates, Deepwell Plates and Microplates

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Introduction

Increasingly, laboratories are using 96 and 384 well format plates instead of individual tubes as they simplify and accelerate the handling of large numbers of samples. These plates also enable certain work steps to be more easily automated. To protect the samples used against contamination and evaporation, there are several plate sealing options available (Table 1). The type of seal can be

selected according to the requirements of the respective application regarding tightness or temperature resistance or according to desired handling [1]. If, however, special chemicals such as acids, bases or organic solvents are used, the most important consideration is the compatibility of the seal with the respective substance. This Userguide investigated the chemical resistance of the various sealing options offered by Eppendorf for Deepwell Plates, Microplates and PCR Plates.

Table 1: Overview of the various sealing options and their applications

Sealing options	Eppendorf product	Applications
Heat sealing (for polypropylene plates)	Eppendorf Heat Sealing Film	<i>real-time</i> PCR, PCR, detection, incubation, storage
	Eppendorf Heat Sealing Foil	PCR, incubation, storage
Adhesive seals	Eppendorf Storage Film	Incubation, storage
	Eppendorf Storage Foil	Incubation, storage
	Eppendorf PCR Film	PCR
	Eppendorf PCR Foil	PCR
	Masterclear <i>real-time</i> PCR Film	<i>real-time</i> PCR, detection
Cap Strips (for PCR plates and tube strips)	Cap Strips, domed	PCR
	Cap Strips, flat	PCR, (<i>real-time</i> PCR)
	Masterclear Cap Strips	<i>real-time</i> PCR
Sealing mats (for Deepwell Plates and Microplates)	Eppendorf Sealing Mats	Incubation, storage
Lids (for Deepwell Plates and Microplates)	Eppendorf Plate Lid	Incubation

Materials and Methods

1. Testing the chemical resistance of the seals

With the exception of the Cap Strips, all the Eppendorf-products for sealing plates listed in Table 1 were tested with different chemicals as follows: 100 µL of each substance was added to the seals, incubated at room temperature for 24 hours and then rinsed off with water. The surface was then inspected. A visual inspection was conducted, the function was not checked.

2. Data from literature references on the chemical

resistance of the Cap Strips and the Eppendorf Plate Lid The lid (Eppendorf Plate Lid) is made of polystyrene. In addition to the test, which is described above, data was also collected from literature references concerning the compatibility with various substances [2]. The Cap Strips are made of polypropylene. For this material there already exists a detailed compilation of reference literature data, which is also valid for tubes and plates [3].

Results

Table 2a and 2b contains a summary of the test results of the chemical resistance of the different sealing films and foils. Table 3 provides an overview of the compatibility of the Eppendorf Sealing Mats with various substances. Table 4 shows reference literature data on the resistance of polystyrene at 20 °C. It also includes the test results of

selected chemicals. The compatibility of polypropylene (Cap Strips) with different materials is described in another Application Note [3]. If in doubt, the chemicals used should be tested together with the consumable before the actual work step is performed.

Table 2a: Chemical resistance of Eppendorf Films and Foils

Chemicals	Heat sealing		Adhesive seals				
	Heat Sealing Film	Heat Sealing Foil	Storage Film	Storage Foil	PCR Film	PCR Foil	Masterclear <i>real-time</i> PCR Film
Acetic acid, 12 %	1	1	1	1	0	0	0
Acetonitrile	1	1	1	1	0	0	0
Ammonia solution, 2 %	1	1	1	1	0	0	0
Cesium chloride, saturated	1	1	2	1	0	0	0
Chloroform	1	1	3	1	0	0	0
DMSO, 10 %	1	1	1	1	1	1	1
DMSO, 100 %	1	1	1	1	0	0	0
EDTA, pH 8; 1.8 g/mL	1	1	1	1	1	3	3
Ethanol	1	1	3	1	1	1	1
Ficoll, 1.077 g/mL	2	2	3	3	0	0	0
Formaldehyde, 10 %	0	0	0	0	1	1	2
Formaldehyde, 40 %	1	1	2	1	0	0	0
Formamide, 10 %	0	0	0	0	1	1	1
Formamide, 50 %	1	1	3	1	0	0	0
Glutaraldehyde, 25 %	3	3	3	3	3	3	3
Glycerol, 50 %	1	1	1	1	1	1	1
Hydrochloric acid, 32 %	1	1	1	3	0	0	0
Isopropanol	1	1	2	3	1	1	3

Legend – All values are recommendations without guarantee.

1 Resistant

3 Non-resistant (moderate attack, unsuitable)

2 Conditionally resistant (minor attack)

0 Not tested

Table 2b: Chemical resistance of Eppendorf Films and Foils

Chemicals	Heat sealing		Adhesive seals				
	Heat Sealing Film	Heat Sealing Foil	Storage Film	Storage Foil	PCR Film	PCR Foil	Masterclear <i>real-time</i> PCR Film
Methanol	1	2	1	1	0	0	0
Mineral oil	3	1	3	1	3	3	3
Nitric acid, 6.3 %	1	3	3	3	0	0	0
Nonidet P40, 10 %	1	1	3	3	1	1	2
PEG 8000, 20 %	1	1	3	3	1	3	2
Phenol, water-saturated	1	2	3	1	0	0	0
SDS, 1 %	1	3	1	1	1	1	2
Sodium acetate, pH 5.2; 2 M	1	1	1	1	1	2	1
Sodium hydroxide, 4 %	1	1	2	1	0	0	0
Sulfuric acid, 16 %	1	1	1	2	0	0	0
Trichloroacetic acid, 10 %	1	3	3	3	0	0	0
Trifluoroacetic acid, 10 %	1	2	1	2	0	0	0
TRIS buffer, pH 7.5	1	1	1	1	0	0	0
Triton X-100, 1 %	3	1	3	1	1	1	2
Tween 20, 1 %	3	3	1	1	1	1	1

Legend – All values are recommendations without guarantee.

1 Resistant

2 Conditionally resistant (minor attack)

3 Non-resistant (moderate attack, unsuitable)

0 Not tested

Table 3: Chemical resistance of Eppendorf Sealing Mats

Chemicals	Resistance of Sealing Mats
Acetic acid, 96 %	1
Acetone	1
Acetonitrile	1
Ammonia solution, 25 %	1
Cesium chloride, saturated	1
Chloroform	3
DMSO, 10 %	1
DMSO, 50 %	1
DMSO, 100 %	1
EDTA, pH 8.0, 1.8 g/mL	1
Ethanol	1
Ficoll, 1.077 g/mL	1
Formaldehyde, 40 %	3
Glutaraldehyde, 25 %	3
Glycerol, 50 %	1
Guanidine isothiocyanate, 4 M	1

Legend – All values are recommendations without guarantee.

1 Resistant

2 Non-resistant

Chemicals	Resistance of Sealing Mats
Hydrochloric acid, 32 %	1
Isopropanol	1
Methanol	1
Mineral oil	1
Nitric acid, 6.3 %	3
Phenol, water-saturated	1
SDS, 1 %	1
Sodium acetate, pH 5.2, 2 M	1
Sodium hydroxide, 20 %	1
Sulfuric acid, 16 %	1
Trichloroacetic acid, 40 %	1
Trifluoroacetic acid, 10 %	1
TRIS buffer, pH 7.5, 1 M	1
Triton X-100, 1 %	1
Tween 20, 1 %	1

Table 4: Chemical resistance of Eppendorf Plate Lid

Chemicals	Resistance of Plate Lid
Acetic acid, 50 %	1
Acetic acid, 100 % (pure acetic acid)	2
Acetone, 100 %	3*
Ammonia solution, 25 %	1
Chloroform	3
Dimethylformamide	3
DMSO, 100 %	2*
Ethanol	1*
Formaldehyde, 30 %	1
Glycerol	1

Chemicals	Resistance of Plate Lid
Hydrochloric acid, conc.	1
Isopropanol	1
Methanol	1
Mineral oil	1*
Nitric acid, 30 %	1
Nitric acid, conc.	2
Paraffin oil	1*
Phenol, water-saturated	3*
Sulfuric acid, 50 %	1
Toluol	3*

Legend – All values are recommendations without guarantee.

*Result of our own testing

1 Resistant (several months lifetime)

2 Conditionally resistant (a few weeks lifetime)

3 Non-resistant (a few hours lifetime or rapid destruction)

Literature

- [1] Application Note 239: Eppendorf Deepwell Plates and Microplates – Investigations of sealing methods.
 [2] Carlowitz, B.: Kunststofftabellen. 4. Aufl. München: Hanser, 1995.-ISBN 3-446-17603-9.
 [3] Application Note 56: The best material for original Eppendorf Tubes and Plates: Properties and chemical resistance of polypropylene.

Ordering information

Description	Order no. international
Eppendorf Heat Sealing Film, 10 x 10 pcs.	0030 127.838
Eppendorf Heat Sealing Foil, 10 x 10 pcs.	0030 127.854
Eppendorf Storage Film, 100 pcs.	0030 127.870
Eppendorf Storage Foil, 100 pcs.	0030 127.889
PCR Film (self-adhesive), 100 pcs.	0030 127.811
PCR Foil (self-adhesive), 100 pcs.	0030 127.820
Masterclear real-time PCR Film, (self-adhesive), 100 pcs.	0030 132.904
Cap Strips (8-strips), domed, 10 x 12 pcs.	0030 124.839
Cap Strips (8-strips), flat, 10 x 12 pcs.	0030 124.847
Masterclear Cap Strips (10 x 12 pcs.)	0030 132.874
Eppendorf Sealing mats (for Deepwell 96/2000), 50 pcs.	0030 127.579
Eppendorf Sealing mats (for Deepwell 96/1000 and 96/500 and Microplates 96), 50 pcs.	0030 127.552
Eppendorf Plate Lid (PCR clean), 80 pcs.	0030 131.517
Eppendorf Plate Lid (sterile), 80 pcs.	0030 131.525

 Your local distributor: www.eppendorf.com/contact

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