ATTO-TEC

Revised: December 1, 2022

Product Information: Fluorescent Phospholipids

Compound	Storage information	Shelf Life
Fluorescent phospholipid	Freeze upon receipt < -20 °C Desiccate Protect from light	When stored as indicated, fluorescent phospholipids are stable for at least 3 years.
For optical properties see Table 1 on page 2.		

Introduction:

Phospholipids play a major role in cell structure and function. Due to their amphiphilic nature and the ability to form lipid bilayers phospholipids are the predominant building block of biological membranes such as plasma- and intracellular membranes etc. These biological barriers control the passage of a large variety of molecules, both between cells and extracellular space and between different compartments within the cells. Membranes are the turntables for crucial processes in neurobiology, muscle contraction, and cell signaling.

To study and investigate cell structures, processes like lipid metabolism, signal transduction, transmembrane diffusion, etc., lipophilic fluorescent probes are very useful tools. Natural phospholipids are generally very similar in structure. However, minor differences e.g. number and length of the fatty acid chains, degree of unsaturation of the fatty acid and nature of hydrophilic head group may result in significant variations of the physical properties and biological activity of such membranes.

ATTO Fluorescent Phospholipids

ATTO-TEC offers a variety of phospholipids based on glycerol carrying one or two fatty acids (lipophilic groups) and a phosphate monoester residue (hydrophilic group). They are labeled at the hydrophilic head group. After incorporation of the fluorescent phospholipid the fluorophore is located at the water/lipid interface of the membrane. We currently provide **1,2-dipalmitoyl-*sn*-glycero-3-phosphoethanolamine** (DPPE), **1,2-dioleoyl-*sn*-glycero-3-phosphoethanolamine** (DOPE), **palmitoyl-*sn*-glycero-phosphoethanolamine** (PPE), **1,2-dimyristoyl-*sn*-glycero-3-phospho-ethanolamine** (DMPE) and **1,2-dilauroyl-*sn*-glycero-3-phosphoethanolamine** (DLPE) labeled with **ATTO**-dyes (see Table 2).

Storage and Handling:

Fluorescent phospholipid derivatives are supplied in solid form and should be stored at -20 °C, desiccated and protected from light. When stored as indicated, **ATTO**-dye labeled phospholipids are stable for at least three years.

For the preparation of stock solutions, we recommend using chloroform/methanol 80:20 as solvent of choice. The stock solution of labeled phospholipids should be stored in the same way as the solid, however the shelf life of such solutions might be significantly reduced.

Table 1: Properties of available **ATTO**-label:

Label	λ_{abs} , nm	ε_{max} , M^{-1} cm^{-1}	MW, g/mol DPPE	MW, g/mol DOPE	MW, g/mol PPE	MW, g/mol DMPE	MW, g/mol DLPE
ATTO 390	387	24000	1017	1069		961	
ATTO 425	433	45000	1075	1127			
ATTO 430LS	441	32000	1285	1337			
ATTO 465	467	75000		1135			
ATTO 490LS	498	40000	1348	1444			
ATTO 495	503	80000	1025				
ATTO 488	508	90000	1264	1316	1025	1207	1150
ATTO 520	513	110000	1040	1092	802	984	
ATTO 532	543	115000	1320	1372	1081	1264	
ATTO Rho6G	535	115000				1232	
ATTO 540Q	546	120000		1285			
ATTO 542	548	120000	1588				
ATTO 550	565	120000	1382	1420	1130	1312	
ATTO 565	555	120000	1299	1209	596	1128	
ATTO Thio12	579	120000	1276				
ATTO Rho101	584	120000	1364				
ATTO 590	595	120000	1379	1417	1127	1309	
ATTO 594	606	120000	1480	1532	1241	1424	1368
ATTO 620	621	120000	1186				
ATTO 633	630	130000	1326	1378	1088	1270	
ATTO 643	648	150000		1584			1420
ATTO 647	653	120000	1267	1319		1211	
ATTO 647**N**	646	150000	1420	1485	1194	1364	1308
ATTO 655	657	125000	1316	1368	964	1146	1203
ATTO 665	665	160000		1349			
ATTO 680	678	125000	1314	1366			
ATTO 700	694	120000	1353	1292			
ATTO 740	745	120000	1142	1194			
ATTO MB2	658	100000	1130				

λ_{abs}: longest-wavelength absorption maximum in chloroform:methanol 80:20 (V/V); ε_{max}: molar extinction coefficient at the longest-wavelength absorption maximum.

Application

Membrane incorporation of fluorescent lipid analogs can be performed as described in literature[1]. Generally, a complex of the fluorescent labeled phospholipid and Bovine Serum Albumin (BSA) is prepared, dried, preferably redissolved in ethanol and simply injected to cell containing aqueous medium. The densities of the labeled species in a plasma membrane varies with the concentration of the BSA-lipid-complex and conditions (incubation time and temperature).
For recent applications using **ATTO**-dye labeled phospholipids we refer to Literature[2-6].

References

1. Eggeling C, et al., *Direct observation of the nanoscale dynamics of membrane lipids in a living cell*, Nature **457** (2009) 1159–1163.
2. Honigmann, A.; Walter C. et al., *Characterization of Horizontal Lipid Bilayers as a Model System to Study Lipid Phase Separation*, Biophysical Journal **98** (2010), 2886-2894
3. Vicidomini, G.; Ta, H. et al., *STED-FLCS: An Advanced Tool to Reveal Spatiotemporal Heterogeneity of Molecular Membrane Dynamics*, Nano letters **15** (2015), 5912-5918.
4. Cardoso Dos Santos, M.; Vézy, C.; Jaffiol, R., *Nanoscale characterization of vesicle adhesion by normalized total internal reflection fluorescence microscopy*, Biochimica et Biophysica Acta – Biomembranes **1858** (2016), 1244-1253.
5. Schmid, E. M.; Bakalar, M. H. et al., *Size-dependent protein segregation at membrane interfaces*, Nature Physics **12** (2016), 704-711.
6. Johnson, A.; Bao, P. et al., *Simple, Direct Routes to Polymer Brush Traps and Nanostructures for Studies of Diffusional Transport in Supported Lipid Bilayers*, Langmuir **33** (2017), 3672-3679.

Table 2: **ATTO**-Labeled Phospholipids Order Information:

Dye	Order Code				
	DPPE 1 mg 5 mg	**DOPE 1 mg 5 mg**	**PPE 1 mg 5 mg**	**DMPE 1 mg 5 mg**	**DLPE 1 mg 5 mg**
ATTO 390	AD 390-151 AD 390-155	AD 390-161 AD 390-165		AD 390-191 AD 390-195	
ATTO 425	AD 425-151 AD 425-155	AD 425-161 AD 425-165			
ATTO 430LS	AD 430LS-151 AD 430LS-155	AD 430LS-161 AD 430LS-165			
ATTO 465		AD 465-161 AD 465-165			
ATTO 495	AD 495-151 AD 495-155				
ATTO 488	AD 488-151 AD 488-155	AD 488-161 AD 488-165	AD 488-181 AD 488-185	AD 488-191 AD 488-195	AD 488-241 AD 488-245
ATTO 490LS	AD 490LS-151 AD 490LS-155	AD 490LS-161 AD 490LS-165			
ATTO 520	AD 520-151 AD 520-155	AD 520-161 AD 520-165	AD 520-181 AD 520-185	AD 520-191 AD 520-195	
ATTO 532	AD 532-151 AD 532-155	AD 532-161 AD 532-165	AD 532-181 AD 532-185	AD 532-191 AD 532-195	

Dye	Order Code				
	DPPE 1 mg 5 mg	DOPE 1 mg 5 mg	PPE 1 mg 5 mg	DMPE 1 mg 5 mg	DLPE 1 mg 5 mg
ATTO Rho6G				AD Rho6G-191 AD Rho6G-195	
ATTO 540Q		AD 540Q -161 AD 540O -165			
ATTO 542	AD 542-151 AD 542-155				
ATTO 550	AD 550-151 AD 550-155	AD 550-161 AD 550-165	AD 550-181 AD 550-185	AD 550-191 AD 550-195	
ATTO 565	AD 565-151 AD 565-155	AD 565-161 AD 565-165	AD 565-181 AD 565-185	AD 565-191 AD 565-195	
ATTO Thio12	AD Thio21-151 AD Thio12-155				
ATTO Rho101	AD Rho101-151 AD Rho101-155				
ATTO 590	AD 590-151 AD 590-155	AD 590-161 AD 590-165	AD 590-181 AD 590-185	AD 590-191 AD 590-195	
ATTO 594	AD 594-151 AD 594-155	AD 594-161 AD 594-165	AD 594-181 AD 594-185	AD 594-191 AD 594-195	AD 594-241 AD 594-245
ATTO 620	AD 620-151 AD 620-155				
ATTO 633	AD 633-151 AD 633-155	AD 633-161 AD 633-165	AD 633-181 AD 633-185	AD 633-191 AD 633-195	
ATTO 643		AD 643-161 AD 643-165			AD 643-241 AD 643-245
ATTO 647	AD 647-151 AD 647-155	AD 647-161 AD 647-165		AD 647-191 AD 647-195	
ATTO 647**N**	AD 647**N**-151 AD 647**N**-155	AD 647**N**-161 AD 647**N**-165	AD 647**N**-181 AD 647**N**-185	AD 647**N**-191 AD 647**N**-195	AD 647**N**-241 AD 647**N**-245
ATTO 655	AD 655-151 AD 655-155	AD 655-161 AD 655-165	AD 655-181 AD 655-185	AD 655-191 AD 655-195	AD 655-241 AD 655-245
ATTO 665		AD 665-161 AD 665-165			
ATTO 680	AD 680-151 AD 680-155	AD 680-161 AD 680-165			
ATTO 700	AD 700-151 AD 700-155	AD 700-161 AD 700-165			
ATTO 740	AD 740-151 AD 740-155	AD 740-161 AD 740-165		AD 740-191 AD 740-195	
ATTO MB2	AD MB2-151 AD MB2-155				
ATTO 565	AD 565-151 AD 565-155	AD 565-161 AD 565-165	AD 565-181 AD 565-185	AD 565-191 AD 565-195	
ATTO Thio12	AD Thio21-151 AD Thio12-155				
ATTO Rho101	AD Rho101-151 AD Rho101-155				
ATTO 590	AD 590-151 AD 590-155	AD 590-161 AD 590-165	AD 590-181 AD 590-185	AD 590-191 AD 590-195	

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ATTO 594	AD 594-151 AD 594-155	AD 594-161 AD 594-165	AD 594-181 AD 594-185	AD 594-191 AD 594-195	AD 594-241 AD 594-245
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ATTO 643		AD 643-161 AD 643-165			AD 643-241 AD 643-245
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ATTO 665		AD 665-161 AD 665-165			
ATTO 680	AD 680-151 AD 680-155	AD 680-161 AD 680-165			
ATTO 700	AD 700-151 AD 700-155	AD 700-161 AD 700-165			
ATTO 740	AD 740-151 AD 740-155	AD 740-161 AD 740-165		AD 740-191 AD 740-195	
ATTO MB2	AD MB2-151 AD MB2-155				

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