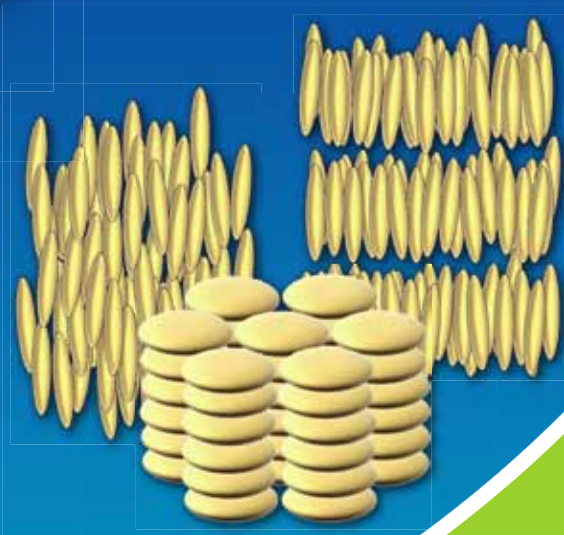
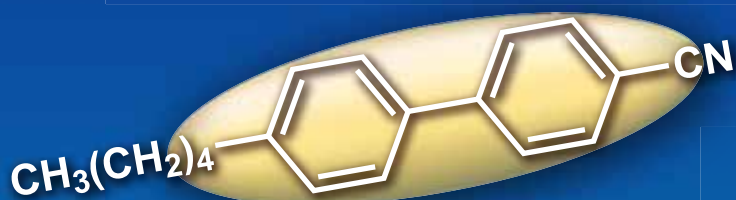


液晶材料

Liquid Crystal Materials



向列相&近晶相液晶

胆甾相液晶

盘状液晶

液晶材料

液晶是既具有液体的流动性，又具有晶体的有序性的状态（或化合物）。具体而言，与普通的晶态相比，液晶态的独特之处在于，其拥有有序的分子取向，但分子重心的位置顺序却是部分或完全缺失的。热致液晶和溶致液晶是液晶的两个主要分类。前者通过改变温度产生，后者则是通过改变两性分子化合物溶液的浓度获得。

多数热致液晶分子的形状呈棒状或盘状。其中，棒状液晶通常呈现出几种中间相：向列相，近晶相，和胆甾相。这些液晶相的形成赋予了化合物如光学各向异性 and 铁电性等特性。除了棒状和盘状液晶，其它具有独特分子形状的液晶也受到了广泛的研究，比如拥有弯曲核心的香蕉型^{1,2)}，以及羽毛球形状的富勒烯衍生物³⁾。

向列相中分子沿分子长轴方向有序排列，分子重心却像各向同性液体一样随机排列(Fig.1(a))。当可能呈现多种液晶相时，向列相通常需要比其它中间相更高的温度。TN（扭曲向列）⁴⁾ 模式液晶显示器就需要介电常数各向异性大并且快速响应的向列相液晶分子，比如5CB (4-氰基-4'-戊基联苯)。

近晶相呈现有序的分子排列，分子沿分子长轴方向排布，同时形成如图Fig.1(b)所示的层状结构。形成这些相的温度范围比向列相低，流动性也更低。各层内分子排列的不同，以及层间和层内的顺序不同，使得近晶相是多种多样的。

胆甾相，如图Fig.1(c)所示，通常存在于胆甾醇化合物中。基于手性分子，该相呈现扭曲的分子排列，并形成具有一定周期性（螺距）的螺旋状结构。该相也可以被归类为向列相，又称为手性向列相。在向列相液晶中加入手性诱导剂也可以得到胆甾相。因为螺距会随温度变化而改变反射颜色，因此适用于液晶温度计。

盘状液晶由盘状分子组成(Fig.1(d))，根据分子排列的不同可以分为更多的具体种类，比如盘状向列相和盘状柱状相。这种液晶在1977年被首次发现，是一类相对新型的液晶相⁵⁾。

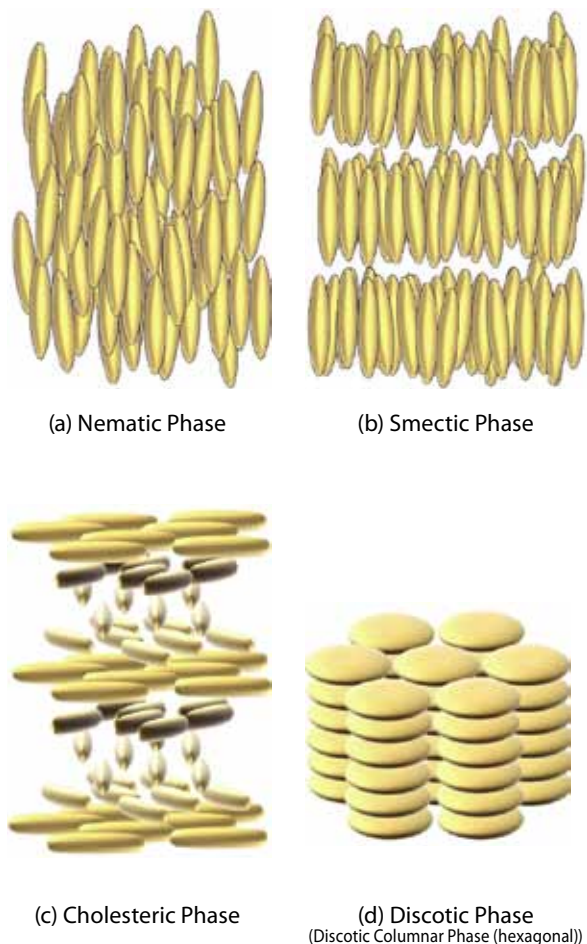


Fig. 1 Illustration of typical liquid crystal phases

● 具有复杂3D结构的液晶相

一些具有复杂3D分子排列的中间相也已经被发现。其中最具有代表性的是蓝相，其有望作为一种用于快速响应显示器的有力候选材料被应用，该显示器没有定向膜和偏振器^{6,7)}，此外，也可作为光子晶体用于激光震荡^{8,9)}。蓝相包含双扭曲圆柱的基本结构，因此所有的相都是光学各向同性，比如体心立方（蓝相I），简单立方（蓝相II），以及无定形（蓝相III）。他们通常介于胆甾相和各向同性相之间，在一个很小的温度范围内（通常约1°C）才能被观察到。这就导致其应用受到了限制。近些年，一些研究组也报道了一些积极的例子，比如通过在蓝相中形成聚合物（聚合物稳定蓝相）将温度范围扩大到约60°C¹⁰⁾，以及通过开发双联苯连接的化合物扩大至约40°C¹¹⁾。

● 聚合物分散液晶

聚合物分散液晶(PDLC)被用于“智能窗”，可以通过开关电压改变窗户的透明度。在PDLC薄膜中，液晶微粒分散在聚合物基体中。电压打开时可以使薄膜变透明，这是因为液晶分子光轴方向与电场方向一致，从而使液晶微粒对入射光的折射率几乎与聚合物基体相同。另一方面，电压关闭时则可以使薄膜变为半透明，这是因为液晶分子的位置变为随机排列，从而使液晶的折射率变得与基体不同。除了智能窗外，PDLC还有望用作电子纸等小功率反射式显示器的材料。

● 液晶半导体

具有液晶性的有机半导体也得到了大量开发。液晶半导体可以用低成本的湿法生产元件，也能在后处理过程中利用自组织能力改善分子取向和载流子迁移率，与晶体有机半导体相比，抗弯曲强度高，可以制造柔性器件，因而引起了很多关注。除了棒状液晶半导体¹²⁾，盘状型也被开发出来¹³⁾。盘状液晶半导体在堆叠分子的圆柱方向呈现出有效的载流子迁移率，因此，可以用作有机太阳能电池(OPVs)材料¹⁴⁾。

● 提供功能的液晶介质的应用

液晶也可以用作反应介质，为其它材料提供一些特殊的功能。几十年前，就利用乙炔在液晶溶剂中聚合来控制聚合物聚集纤维结构的排列，从而提高定向电导率¹⁵⁾。类似的研究还包括在溶致液晶组成的反应介质中进行介孔氧化硅的合成¹⁶⁾，以及在液晶介质中实现的定向碳纳米管¹⁷⁾。

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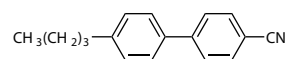
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Nematic / Smectic
Liquid Crystals

氰基联苯&类似物

Cyanobiphenyls &
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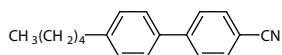
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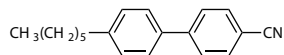
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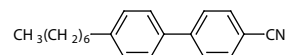
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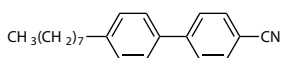
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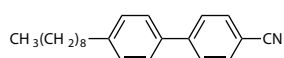
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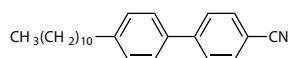
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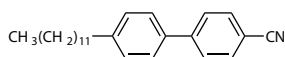
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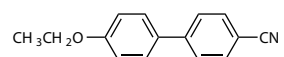
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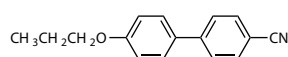
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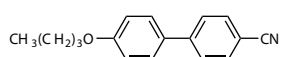
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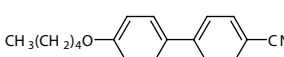
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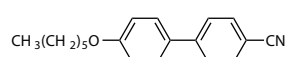
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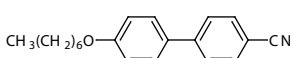
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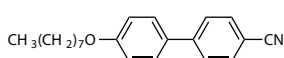
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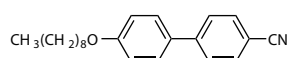
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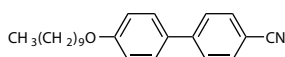
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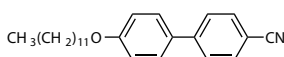
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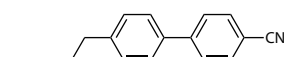
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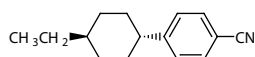
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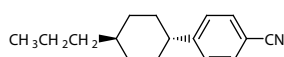
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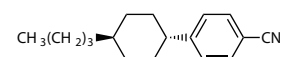
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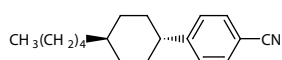
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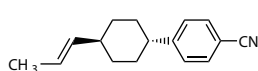


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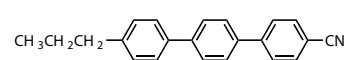
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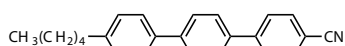
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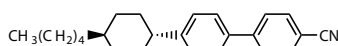
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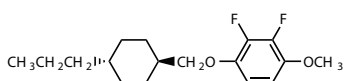
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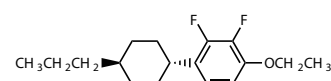
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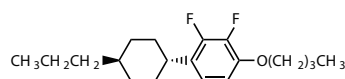
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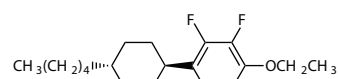
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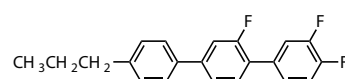
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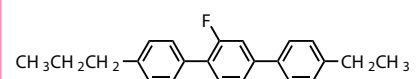
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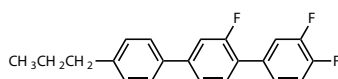
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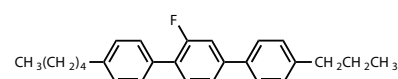
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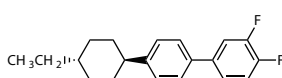
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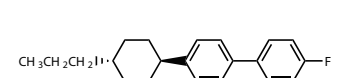
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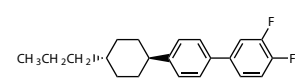
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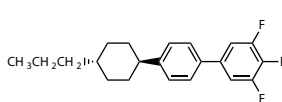
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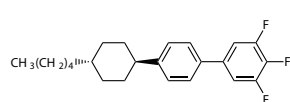
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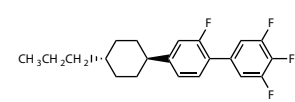
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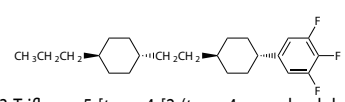
T3397 1g 5g

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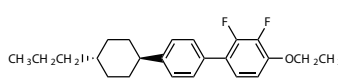
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CAS RN: 173837-35-9

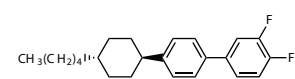
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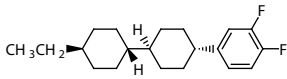
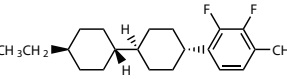
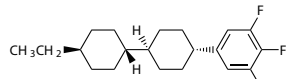
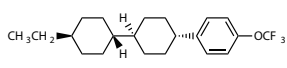
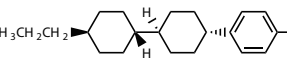
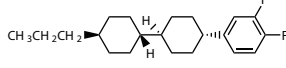
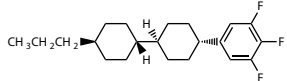
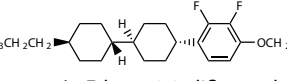
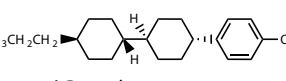
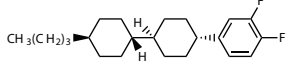
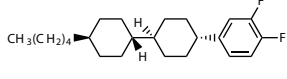
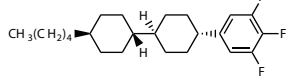
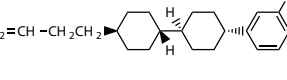
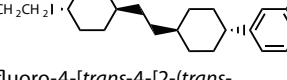
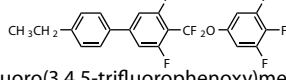
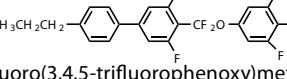
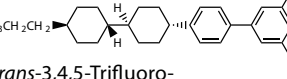
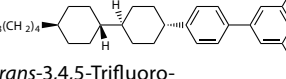
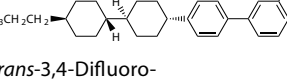
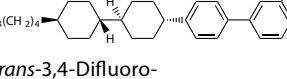
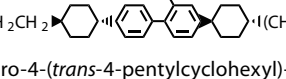
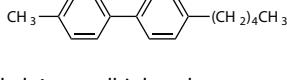
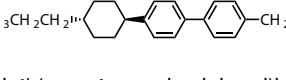
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CAS RN: 131819-24-4

E1158 5g 25g

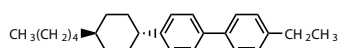
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CAS RN: 189750-98-9

D4534 5g 25g

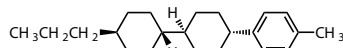
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<p>D3856 1g 5g</p>  <p><i>trans</i>-4-(3,4-Difluorophenyl)-<i>trans</i>-4'-ethylbicyclohexane CAS RN: 118164-50-4</p>	<p>D5127 1g 5g</p>  <p><i>trans,trans</i>-4-(2,3-Difluoro-4-methylphenyl)-4'-ethylbicyclohexyl CAS RN: 174350-08-4</p>	<p>E1156 5g 25g</p>  <p><i>trans,trans</i>-4'-Ethyl-4-(3,4,5-trifluorophenyl)bicyclohexyl CAS RN: 139215-80-8</p>
<p>E1165 5g</p>  <p><i>trans,trans</i>-4'-Ethyl-4-(4-trifluoromethoxyphenyl)bicyclohexyl CAS RN: 135734-59-7</p>	<p>F1102 1g 5g</p>  <p><i>trans,trans</i>-4-(4-Fluorophenyl)-4'-propylbicyclohexyl CAS RN: 82832-27-7</p>	<p>D4797 1g 5g</p>  <p><i>trans,trans</i>-4-(3,4-Difluorophenyl)-4'-propylbicyclohexyl CAS RN: 82832-57-3</p>
<p>P2314 5g 25g</p>  <p><i>trans,trans</i>-4'-Propyl-4-(3,4,5-trifluorophenyl)bicyclohexyl CAS RN: 131819-23-3</p>	<p>E1157 1g 5g</p>  <p><i>trans,trans</i>-4-(4-Ethoxy-2,3-difluorophenyl)-4'-propylbicyclohexyl CAS RN: 123560-48-5</p>	<p>P2464 1g</p>  <p><i>trans,trans</i>-4'-Propyl-4-(4-trifluoromethoxyphenyl)bicyclohexyl CAS RN: 133937-72-1</p>
<p>B4925 5g 25g</p>  <p><i>trans,trans</i>-4'-Butyl-4-(3,4-difluorophenyl)bicyclohexyl CAS RN: 82832-58-4</p>	<p>D4798 1g 5g</p>  <p><i>trans,trans</i>-4-(3,4-Difluorophenyl)-4'-pentylbicyclohexyl CAS RN: 118164-51-5</p>	<p>P2319 5g</p>  <p><i>trans,trans</i>-4'-Pentyl-4-(3,4,5-trifluorophenyl)bicyclohexyl CAS RN: 137644-54-3</p>
<p>B4916 1g 5g</p>  <p><i>trans,trans</i>-4'-(3-Butenyl)-4-(3,4-difluorophenyl)bicyclohexyl CAS RN: 155266-68-5</p>	<p>D5128 1g 5g</p>  <p>1,2-Difluoro-4-[<i>trans</i>-4-[2-(<i>trans</i>-4-propylcyclohexyl)ethyl]cyclohexyl]benzene CAS RN: 117943-37-0</p>	<p>D5129 1g 5g</p>  <p>4-[Difluoro(3,4,5-trifluorophenoxy)methyl]-4'-ethyl-3,5-difluorobiphenyl CAS RN: 303186-19-8</p>
<p>D5130 1g 5g</p>  <p>4-[Difluoro(3,4,5-trifluorophenoxy)methyl]-3,5-difluoro-4'-propylbiphenyl CAS RN: 303186-20-1</p>	<p>T3319 1g 5g</p>  <p><i>trans,trans</i>-3,4,5-Trifluoro-4'-(4'-propylbicyclohexyl-4-yl)biphenyl CAS RN: 137529-41-0</p>	<p>T3482 1g 5g</p>  <p><i>trans,trans</i>-3,4,5-Trifluoro-4'-(4'-pentylbicyclohexyl-4-yl)biphenyl CAS RN: 137529-43-2</p>
<p>D5650 1g 5g</p>  <p><i>trans,trans</i>-3,4-Difluoro-4'-(4'-propylbicyclohexyl-4-yl)biphenyl CAS RN: 119990-81-7</p>	<p>D5651 1g 5g</p>  <p><i>trans,trans</i>-3,4-Difluoro-4'-(4'-pentylbicyclohexyl-4-yl)biphenyl CAS RN: 136609-96-6</p>	<p>F1122 1g 5g</p>  <p>2-Fluoro-4-(<i>trans</i>-4-pentylcyclohexyl)-4'-(<i>trans</i>-4-propylcyclohexyl)biphenyl CAS RN: 106349-49-9</p>
<p>其它联苯&类似物 Other Biphenyls & Analogs</p>	<p>M2885 1g 5g</p>  <p>4'-Methyl-4-pentylbiphenyl CAS RN: 64835-63-8</p>	<p>E1162 5g 25g</p>  <p>4-Ethyl-4'-(<i>trans</i>-4-propylcyclohexyl)biphenyl CAS RN: 84540-37-4</p>

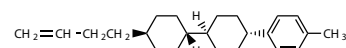
E1254 1g 5g

4-Ethyl-4'-(*trans*-4-pentylcyclohexyl)biphenyl
CAS RN: 79709-85-6

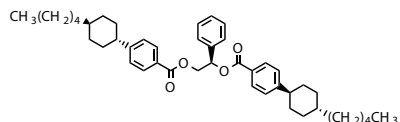
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*trans,trans*-4'-(3-propyl-4-(*p*-tolyl)bicyclohexyl)
CAS RN: 84656-75-7

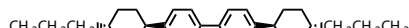
B4915 1g 5g

*trans,trans*-4'-(3-Butenyloxy)-4-(*p*-tolyl)bicyclohexyl
CAS RN: 129738-42-7

P2150 200mg 1g

(R)-1-Phenyl-1,2-ethanediyl
Bis[4-(*trans*-4-pentylcyclohexyl)benzoate]
CAS RN: 154102-21-3

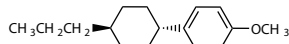
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4,4'-Bis(*trans*-4-propylcyclohexyl)biphenyl
CAS RN: 85600-56-2

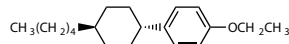
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CAS RN: 97398-80-6

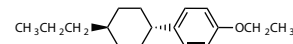
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1-Methoxy-4-(*trans*-4-propylcyclohexyl)benzene
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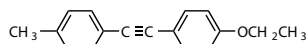
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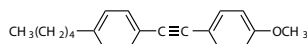
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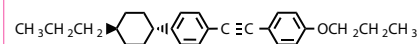
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1-Ethoxy-4-(*p*-tolylethynyl)benzene
CAS RN: 116903-46-9

M3230 5g 25g

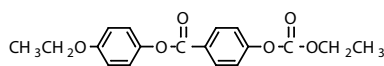
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CAS RN: 39969-28-3

P2440 1g 5g

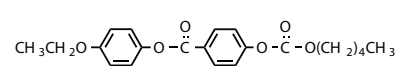
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CAS RN: 116903-49-2

碳酸酯 Carbonates

E0257 1g

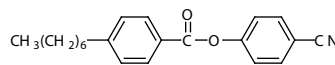
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A0608 1g

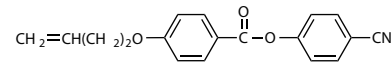
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苯基酯 Phenyl Esters

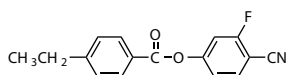
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4-Cyanophenyl 4-Heptylbenzoate
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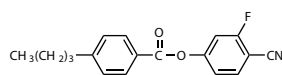
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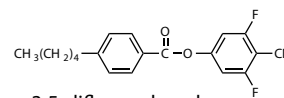
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4-Cyano-3-fluorophenyl 4-Ethylbenzoate
CAS RN: 86776-50-3

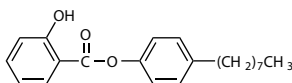
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4-Cyano-3-fluorophenyl 4-Butylbenzoate
CAS RN: 86776-52-5

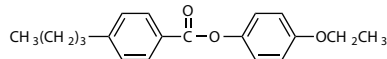
C3512 1g 5g

4-Cyano-3,5-difluorophenyl
4-Pentylbenzoate
CAS RN: 123843-69-6

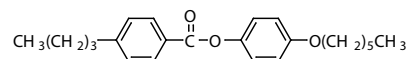
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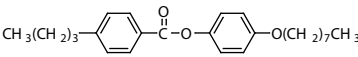
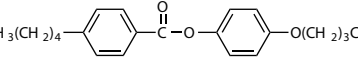
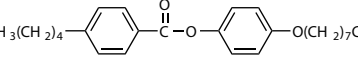
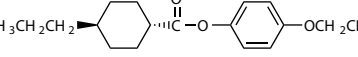
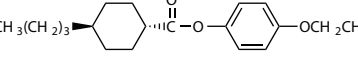
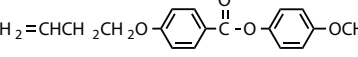
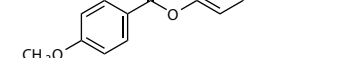
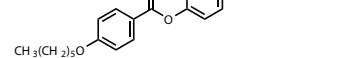
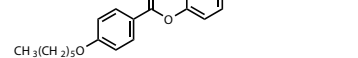
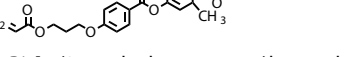
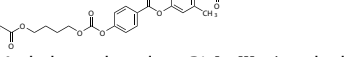
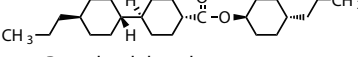

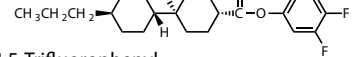
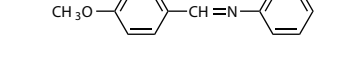
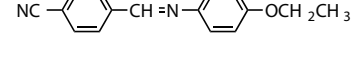
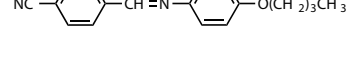
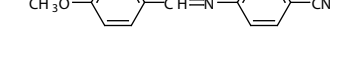
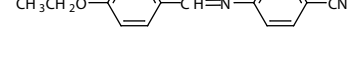
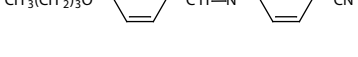
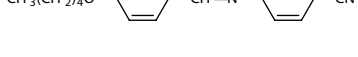
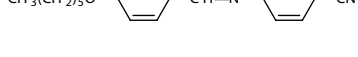
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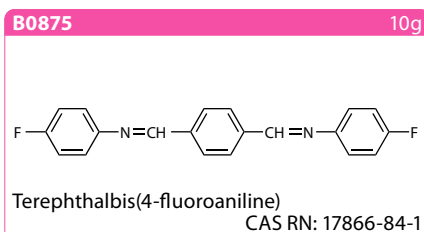
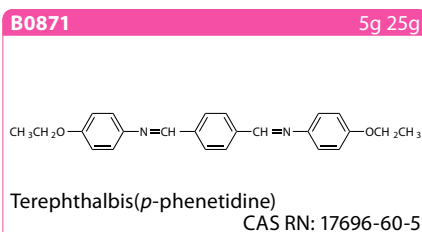
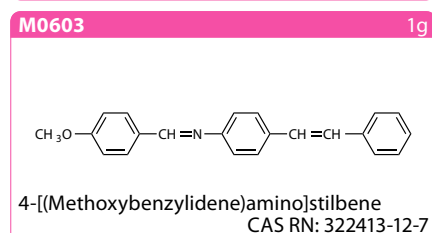
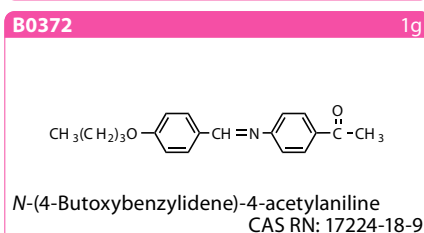
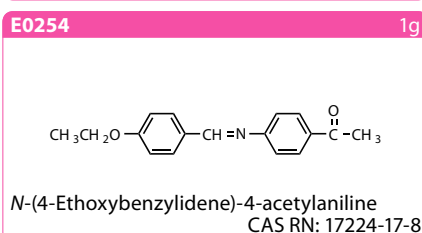
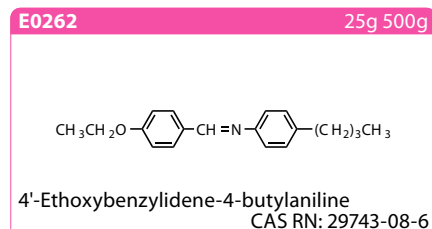
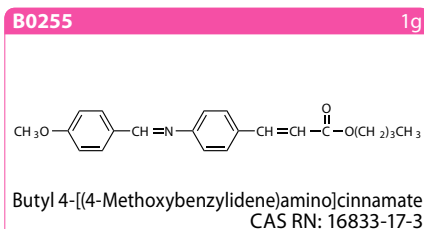
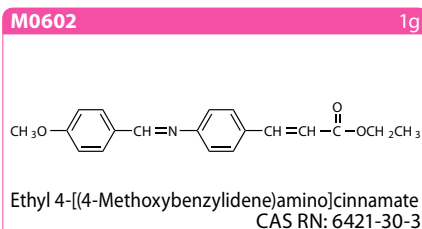
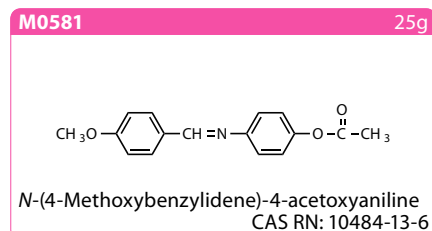
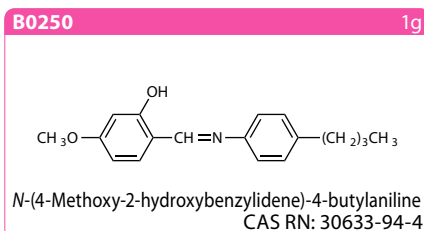
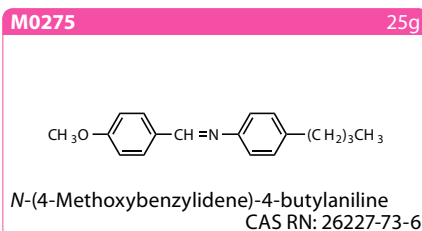
B0375 1g

4-Ethoxyphenyl 4-Butylbenzoate
CAS RN: 62716-65-8

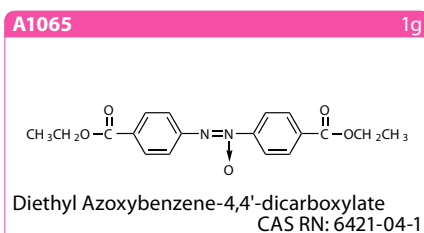
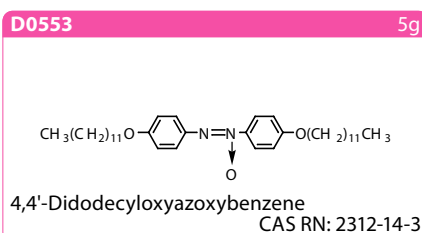
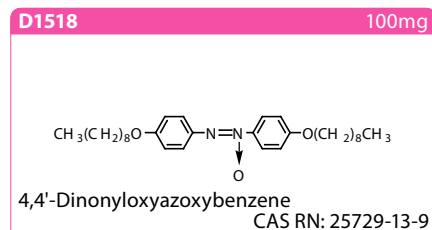
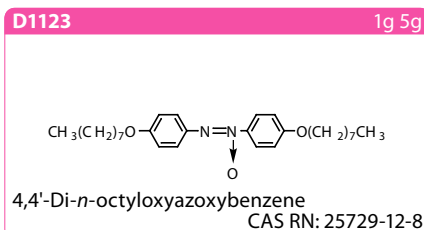
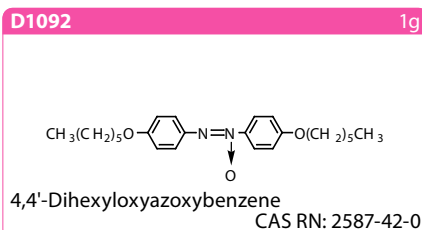
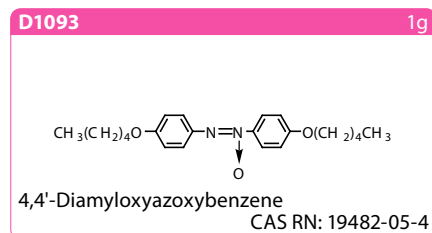
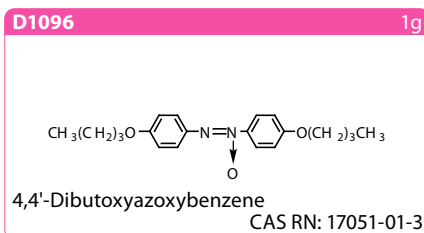
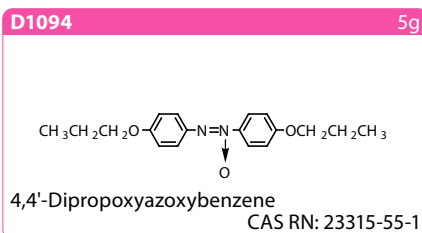
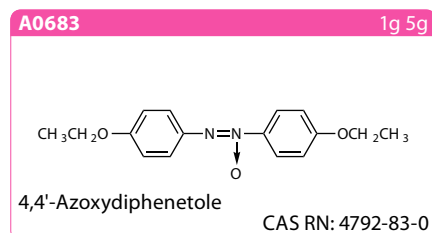
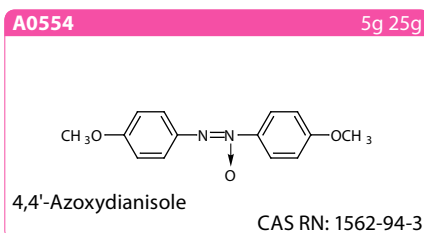
B1091 1g

4-(Hexyloxy)phenyl 4-Butylbenzoate
CAS RN: 38454-28-3

<p>B1092 1g</p>  <p>4-<i>n</i>-Octyloxyphenyl 4-Butylbenzoate CAS RN: 42815-59-8</p>	<p>P0896 1g</p>  <p>4-Butoxyphenyl 4-Pentylbenzoate CAS RN: 51128-24-6</p>	<p>P0898 5g</p>  <p>4-<i>n</i>-Octyloxyphenyl 4-Pentylbenzoate CAS RN: 50649-64-4</p>
<p>E1395 25g 100g</p>  <p>4-Ethoxyphenyl <i>trans</i>-4-Propylcyclohexanecarboxylate CAS RN: 67589-39-3</p>	<p>E1396 25g 100g</p>  <p>4-Ethoxyphenyl <i>trans</i>-4-Butylcyclohexanecarboxylate CAS RN: 67589-47-3</p>	<p>M2106 1g 5g</p>  <p>4-Methoxyphenyl 4-(3-Butenyloxy)benzoate CAS RN: 76487-56-4</p>
<p>P2692 5g</p>  <p>4-Pentylphenyl 4-Methoxybenzoate CAS RN: 38444-13-2</p>	<p>O0461 1g 5g</p>  <p>(<i>S</i>)-2-Octyl 4-[4-(Hexyloxy)benzoyloxy]-benzoate CAS RN: 87321-20-8</p>	<p>O0460 1g</p>  <p>(<i>R</i>)-2-Octyl 4-[4-(Hexyloxy)benzoyloxy]-benzoate CAS RN: 133676-09-2</p>
<p>B5356 200mg 1g</p>  <p>1,4-Bis[4-(3-acryloyloxypropoxy)benzoyloxy]-2-methylbenzene CAS RN: 174063-87-7</p>	<p>M3368 5g 25g</p>  <p>2-Methyl-1,4-phenylene Bis[4-[[[4-(acryloyloxy)butoxy]carbonyl]oxy]benzoate] CAS RN: 187585-64-4</p>	<p>P2436 1g 5g</p>  <p><i>trans</i>-4-Propylcyclohexyl <i>trans,trans</i>-4'-Propylbicyclohexyl-4-carboxylate CAS RN: 83242-83-5</p>
<p>P2696 1g 5g</p>  <p>4-(<i>trans</i>-4-Pentylcyclohexyl)phenyl (<i>trans,trans</i>)-4'-Propyl-[1,1'-bi(cyclohexane)]-4-carboxylate CAS RN: 131790-57-3</p>	<p>T3756 5g 25g</p>  <p>3,4,5-Trifluorophenyl <i>trans,trans</i>-4'-Propylbicyclohexyl-4-carboxylate CAS RN: 132123-45-6</p>	
<p>席夫碱 Schiff Bases</p>	<p>M0582 5g 25g</p>  <p><i>N</i>-(4-Methoxybenzylidene)aniline CAS RN: 836-41-9</p>	<p>C0744 1g</p>  <p>4'-Cyanobenzylidene-4-ethoxyaniline CAS RN: 34128-02-4</p>
<p>C0743 1g</p>  <p>4'-Cyanobenzylidene-4-butoxyaniline CAS RN: 55873-21-7</p>	<p>M0604 1g</p>  <p>4-[[4-Methoxybenzylidene]amino]benzonitrile CAS RN: 13036-19-6</p>	<p>E0240 1g</p>  <p>4'-Ethoxybenzylidene-4-cyanoaniline CAS RN: 24742-30-1</p>
<p>B0252 1g</p>  <p>4'-Butoxybenzylidene-4-cyanoaniline CAS RN: 36405-17-1</p>	<p>B0253 1g</p>  <p>4'-(Amyloxy)benzylidene-4-cyanoaniline CAS RN: 37075-25-5</p>	<p>H0419 1g</p>  <p>4'-Hexyloxybenzylidene-4-cyanoaniline CAS RN: 35280-78-5</p>

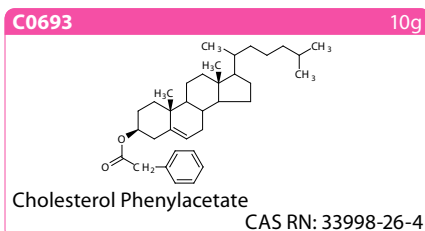
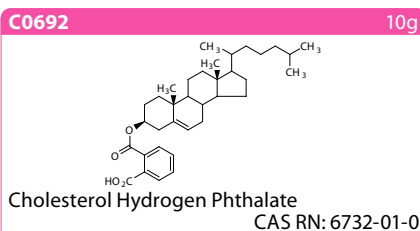
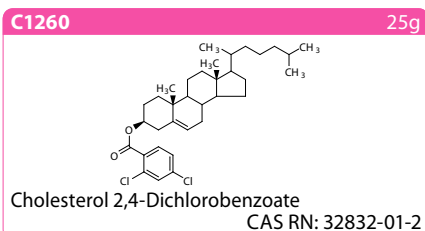
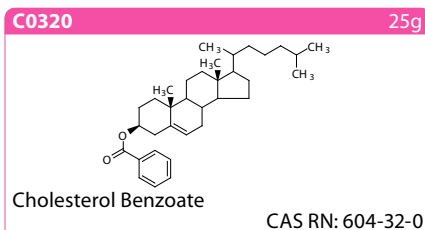
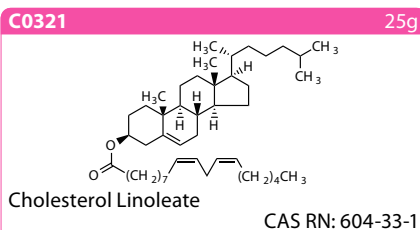
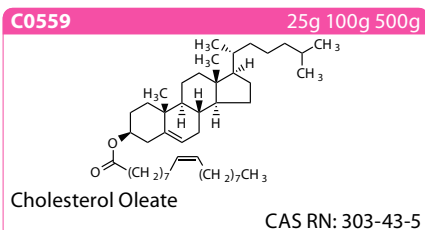
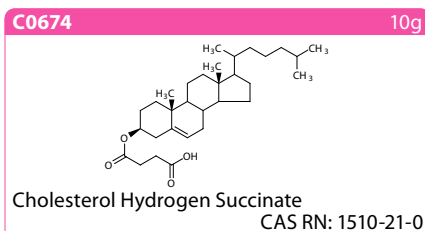
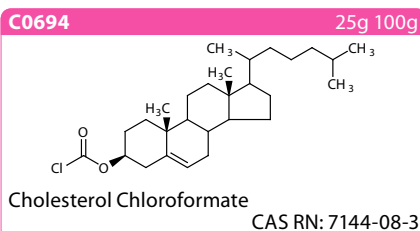
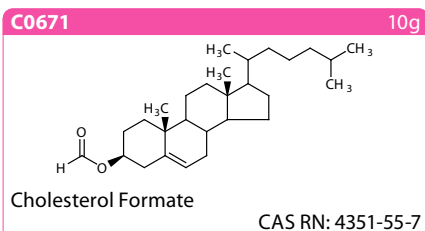
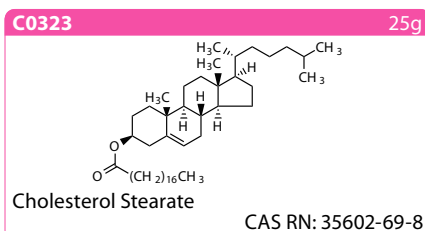
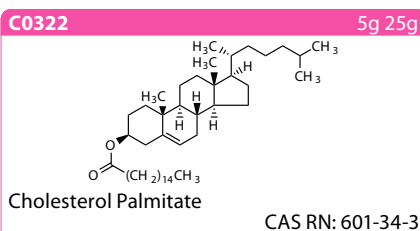
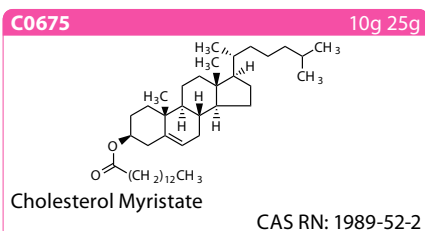
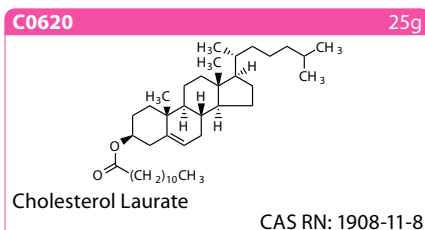
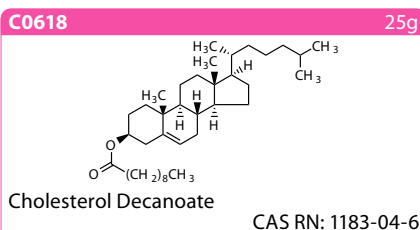
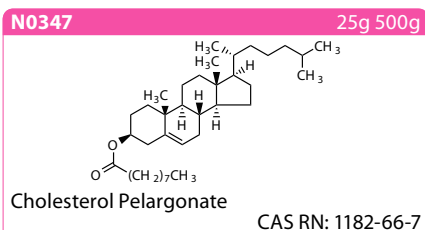
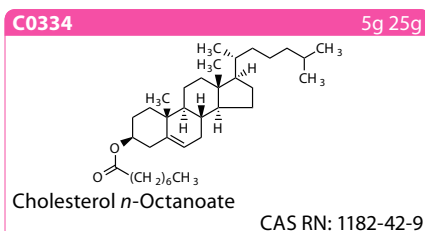
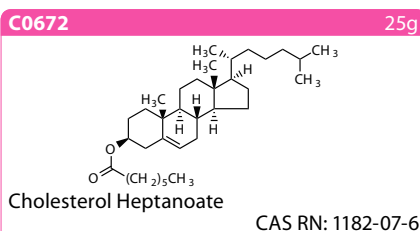
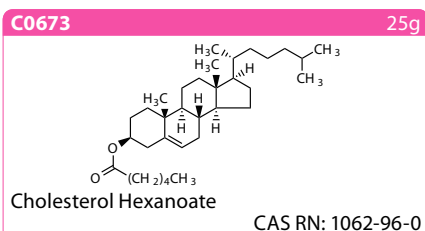
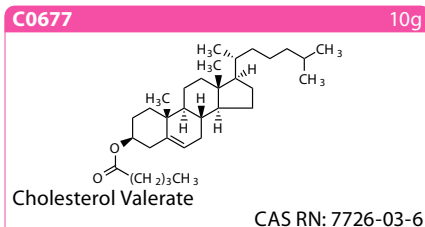
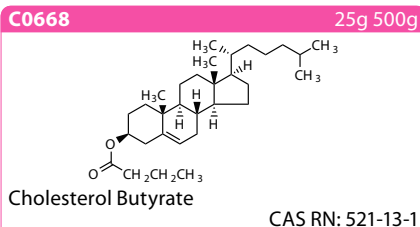
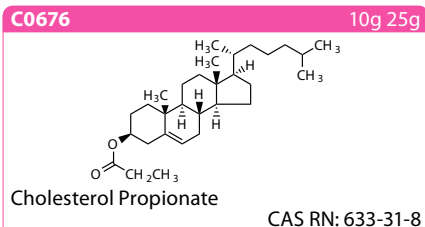
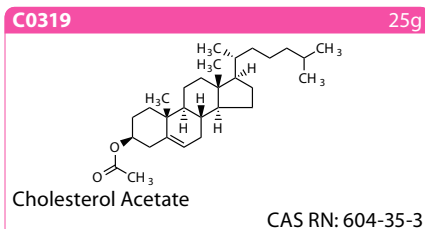


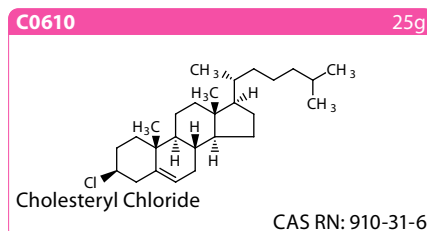
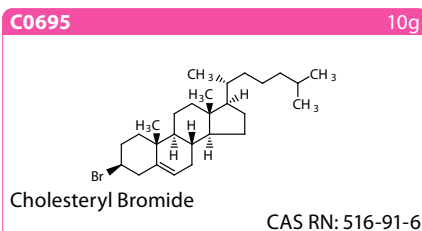
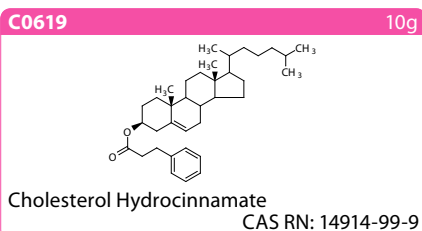
氧化偶氮苯 Azoxybenzenes



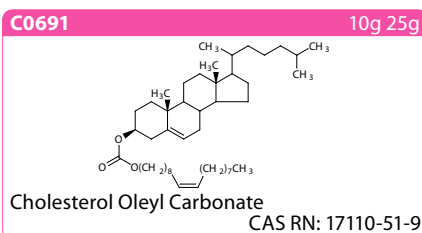
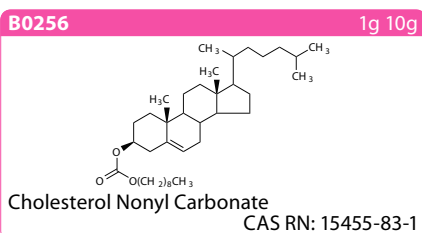
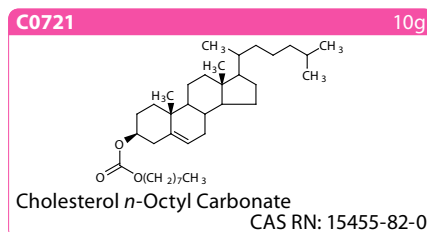
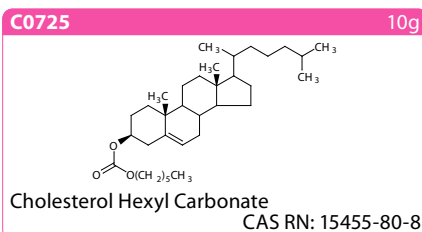
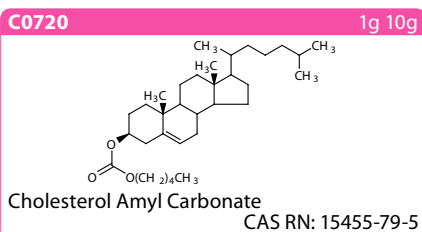
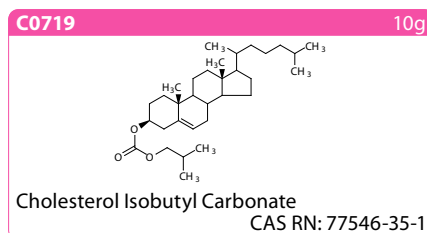
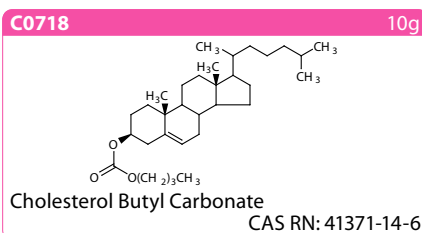
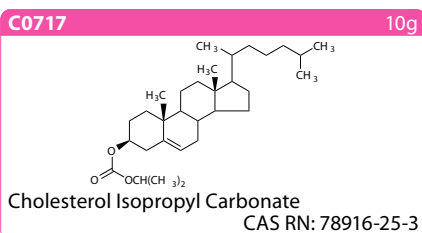
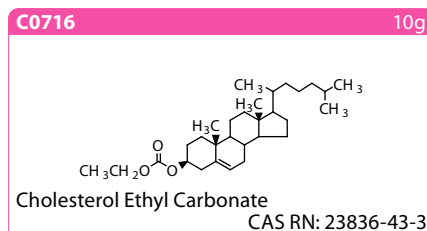
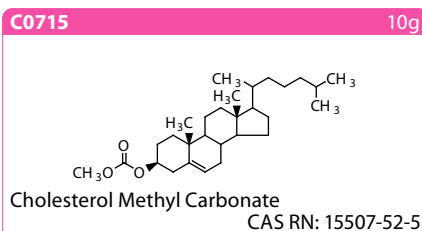
胆甾相液晶
Cholesteric Liquid
Crystals

胆固醇基化合物
Cholesteryl Compounds

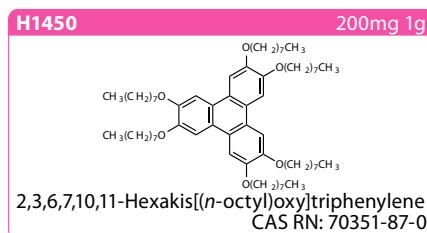
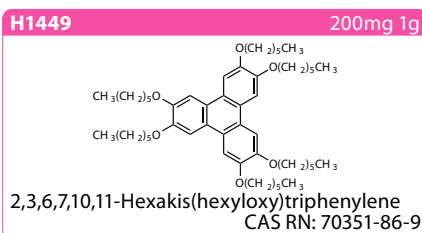




Cholesteryl Carbonates



盘状液晶
Discotic Liquid Crystals





梯希爱(上海)化成工业发展有限公司

试剂热线：800-988-0390或021-67121386

大包装热线：800-988-1865

传真：021-67121385

邮箱：Sales-CN@TCIchemicals.com

地址：上海化学工业区普工路96号

邮编：201507

www.TCIchemicals.com