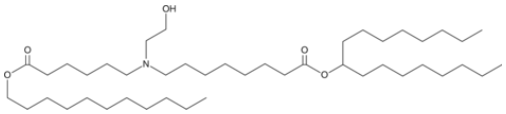
Product Data Sheet

Product Name: SM-102
Cat. No.: GC48385

Chemical Properties

Cas. No.	2089251-47-6		
SMILES	OCCN(CCCCCCCC(OC(CCCCCCCC)CCCCCCCC)=O)CCCCCC(OCCCCCCCCCCC)=O		
Formula	$C_{44}H_{87}NO_5$	M.Wt	710.2
Solubility	Ethanol : ≥ 100 mg/mL (140.81 mM) DMSO ;100 mg/mL (140.81 mM)	Storage	Store at -20°C
General tips	For obtaining a higher solubility , please warm the tube at 37 °C and shake it in the ultrasonic bath for a while.Stock solution can be stored below -20°C for several months.		
Shipping Condition	Evaluation sample solution : ship with blue ice All other available size: ship with RT , or blue ice upon request.		
Structure			

Protocol

Preparation method of SM-102 for lipid nanoparticles (LNPs) [1-2]

This experimental protocol is compiled based on research content and is for reference only. Please adjust according to actual needs.

(1) Reagent preparation: Dissolve SM-102 in ethanol to prepare a 10mg/mL stock solution. Dissolve cholesterol (Catalog No. GC17398), DSPC (Catalog No. GC41832), and DMG-PEG 2000 (Catalog No. GC39784) separately in anhydrous ethanol. Dissolve mRNA in 50mM sodium citrate buffer (pH=4.0). If LNPs need to be labeled, add the DiD fluorescent probe to the lipid ethanol solution at a concentration of 0.2%.

(2) Preparation of lipid nanoparticles: Add 572μL of 10mg/mL SM-102, 240μL of 10mg/mL cholesterol, 127μL of 10mg/mL DSPC, and 61μL of DMG-PEG 2000 per milliliter of lipid mixture. Mix the solution thoroughly to obtain a clear solution. This mixture contains 10mg of total lipids. The lipid

composition is SM-102/cholesterol/DSPC/DMG-PEG at a molar ratio of 50:38.5:10:1.5.

(3) Mixing mRNA with LNPs: The weight ratio of RNA to lipid is 0.05 (wt/wt). Rapid mixing can be achieved by three methods: pipette mixing, vortex mixing, and microfluidic mixing.

a. Pipette mixing method: Aspirate 3mL of mRNA solution and quickly add 1mL of lipid mixture solution (generally using a 1:3 ratio of ethanol lipid mixture to aqueous buffer). Rapidly pipette up and down for 20-30 seconds. Incubate the resulting solution at room temperature for up to 15 minutes.

b. Vortex mixing method: Vortex 3mL of mRNA solution at medium speed on a vortex mixer. Quickly add 1mL of lipid mixture solution into the vortexing solution (usually using a 1:3 ratio of ethanol lipid mixture to aqueous buffer). Continue vortexing the resulting dispersion for 20-30 seconds. Incubate the resulting solution at room temperature for up to 15 minutes.

c. Microfluidic mixing method: Mix 3mL of mRNA buffer with 1mL of lipid mixture solution in a microfluidic device at a total flow rate of 12mL/min (generally using a 1:3 ratio of ethanol lipid mixture to aqueous buffer).

(4) Purification of lipid nanoparticles: After mixing, dialyze the LNPs against PBS (pH=7.4) for 2 hours, sterile filter through a 0.2μm filter, and store at 4°C.

Notes:

(1) LNPs prepared by this method have a particle size of approximately 100nm, a polydispersity index of less than 0.2, and an encapsulation efficiency of up to 98.96%.

(2) LNPs maintain stable particle size and PDI during storage at 4°C for 4 weeks, but mRNA content decreases over time.

(3) For safety and health, please wear a lab coat and disposable gloves during operation.

References:

[1] Escalona-Rayo O, Zeng Y, Knol RA, et al. In vitro and in vivo evaluation of clinically-approved ionizable cationic lipids shows divergent results between mRNA transfection and vaccine efficacy. Biomed Pharmacother. 2023 Sep;165:115065.

[2] Naidu GS, Yong SB, Ramishetti S, et al. A Combinatorial Library of Lipid Nanoparticles for Cell

Type-Specific mRNA Delivery. Adv Sci (Weinh). 2023 Jul;10(19):e2301929.

Background

SM-102 is an ionizable lipid and a key component of lipid nanoparticle (LNP) delivery systems. SM-102 is electrically neutral at physiological pH, has low cytotoxicity, and promotes LNP circulation in the body. After entering cells, SM-102 becomes protonated and positively charged in the acidic endosomal environment. The positively charged SM-102 forms ion pairs with anionic phospholipids on the endosomal membrane, disrupts endosomal membrane stability, achieves endosomal escape, and releases mRNA into the cytoplasm for translation. SM-102 can be used in mRNA vaccine delivery, gene therapy, protein replacement therapy, and COVID-19 related research[1-4].

References:

[1] Escalona-Rayo O, Zeng Y, Knol RA, et al. In vitro and in vivo evaluation of clinically-approved ionizable cationic lipids shows divergent results between mRNA transfection and vaccine efficacy. Biomed Pharmacother. 2023 Sep;165:115065.

[2] Naidu GS, Yong SB, Ramishetti S, et al. A Combinatorial Library of Lipid Nanoparticles for Cell Type-Specific mRNA Delivery. Adv Sci (Weinh). 2023 Jul;10(19):e2301929.

[3] McKenzie RE, Minnell JJ, Ganley M, et al. mRNA Synthesis and Encapsulation in Ionizable Lipid Nanoparticles. Curr Protoc. 2023 Sep;3(9):e898.

[4] Zhang L, More KR, Ojha A, et al. Effect of mRNA-LNP components of two globally-marketed COVID-19 vaccines on efficacy and stability. NPJ Vaccines. 2023 Oct 11;8(1):156.