Product Data Sheet

Product Name: Heparan Sulfate
Cat. No.: GC30767

Chemical Properties

Cas. No.	9050-30-0		
SMILES	O=S(OCC1O[C@@H](OC)[C@@H](NS(=O)([O-])=O)[C@@H](OS(=O)([O-])=O)[C@H]1O[C@@H]2OC(C([O-])=O)[C@H](O[C@@H]3OC(COS(=O)([O-])=O)[C@H](O[C@@H]4OC(C([O-])=O)[C@H](OC)[C@H](O)[C@@H]4OS(=O)([O-])=O)[C@H](O)[C@@H]3NS(=O)([O-])=O)[C@H](O)[C@@H]2O)([O-])=O.[n]		
Formula	$C_{12}H_{19}NO_{20}S_3$ (monomer)	M.Wt	593.47(monomer)
Solubility	Water : 47.1 mg/mL	Storage	Store at -20°C
General tips	For obtaining a higher solubility , please warm the tube at 37 ℃ and shake it in the ultrasonic bath for a while.Stock solution can be stored below -20℃ 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	Heparan Sulfate		

Protocol

Cell experiment [1]:

Cell lines	Calu3 (lung epithelium) and Caco2 (intestinal epithelium) cells

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Preparation Method	Calu3 (lung epithelium) and Caco2 (intestinal epithelium) cells were infected with early passage SARS-CoV-2 pretreated with Heparan sulfate, and samples were collected 24 hours after infection.
Reaction Conditions	0-500ug/ml Heparan sulfate,24h
Applications	Heparan sulfate treatment significantly reduced SARS-CoV-2 replication in cell lysates and supernatant samples of Calu3 and Caco2.

Animal experiment [2]:

Animal models	Sprague-Dawley male rats 3-4 months old
Preparation Method	Groups of rats (n = 5) received a piece of Gelfoam embedded with human recombinant FGF-2 dissolved in PBS, Heparan sulfate (HS; 10 μg/ml) dissolved in PBS, or both, in the right hemispheres.
Dosage form	A piece of Gelfoam embedded with 10 ug/ml Heparan sulfate for two days

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Applications	FGF-2/FGFR system is involved in the regulation of astrocytic reactivity and/or proliferation in the brain and its action is potentiated by Heparan sulfate.

References:

[1]. Chu H, Hu B, et,al. Host and viral determinants for efficient SARS-CoV-2 infection of the human lung. Nat Commun. 2021 Jan 8;12(1):134. doi: 10.1038/s41467-020-20457-w. PMID: 33420022; PMCID: PMC7794309.

[2]. Gómez-Pinilla F, Vu L, et,al. Regulation of astrocyte proliferation by FGF-2 and heparan sulfate in vivo. J Neurosci. 1995 Mar;15(3 Pt 1):2021-9. doi: 10.1523/JNEUROSCI.15-03-02021.1995. PMID: 7891149; PMCID: PMC6578134.

Background

Heparan sulfate (HS) is a complex, polyanionic polysaccharide ubiquitously expressed on cell surfaces and in the extracellular matrix[1]. Heparan sulfate interacts with numerous proteins, including growth factors, morphogens, and adhesion molecules, and thereby regulates important developmental processes in invertebrates and vertebrates[6]. Heparan sulfate proteoglycans can act as receptors for proteases and protease inhibitors regulating their spatial distribution and activity. Membrane Heparan sulfate proteoglycans act as coreceptors for various tyrosine kinase-type growth factor receptors, lowering their activation threshold or changing the duration of signaling reactions[5].

Heparan sulfate treatment significantly reduced SARS-CoV-2 replication in cell lysates and supernatant samples of Calu3 and Caco2. HS serves as an essential host

determinant during SARS-CoV-2 attachment and replication[2].Heparan sulfate influences the binding affinity of intestinal epithelium cells to Wnt, thereby promoting activation of canonical Wnt signaling and facilitating regeneration of small intestinal crypts after epithelial injury[7].

In Sprague-Dawley male rats, FGF-2/FGFR system is involved in the regulation of astrocytic reactivity and/or proliferation in the brain and its action is potentiated by Heparan sulfate [3].Heparan sulfate proteoglycans represent a major component of the extracellular matrix and are critical for brain development, Heparan Sulfate can maintain neuronal excitability, promote synaptic plasticity and learning[5].

References:
[1]: Chhabra M, Doherty GG, et,al. From Cancer to COVID-19: A Perspective on Targeting Heparan Sulfate-Protein Interactions. Chem Rec. 2021 Nov;21(11):3087-3101. doi: 10.1002/tcr.202100125. Epub 2021 Jun 19. PMID: 34145723; PMCID: PMC8441866.
[2]: Chu H, Hu B, et,al. Host and viral determinants for efficient SARS-CoV-2 infection of the human lung. Nat Commun. 2021 Jan 8;12(1):134. doi: 10.1038/s41467-020-20457-w. PMID: 33420022; PMCID: PMC7794309.
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[4]: Minge D, Senkov O, et,al. Heparan Sulfates Support Pyramidal Cell Excitability, Synaptic Plasticity, and Context Discrimination. Cereb Cortex. 2017 Feb 1;27(2):903-918. doi: 10.1093/cercor/bhx003. PMID: 28119345; PMCID: PMC5390399.
[5]: Sarrazin S, Lamanna WC, et,al. Heparan sulfate proteoglycans. Cold Spring Harb Perspect Biol. 2011 Jul 1;3(7):a004952. doi: 10.1101/cshperspect.a004952. PMID: 21690215; PMCID: PMC3119907.
[6]: Kraushaar DC, Dalton S, et,al. Heparan sulfate: a key regulator of embryonic stem cell fate. Biol Chem. 2013 Jun;394(6):741-51. doi: 10.1515/hsz-2012-0353. PMID: 23370908; PMCID: PMC3933957.
[7]: Yamamoto S, Nakase H, et,al. Heparan sulfate on intestinal epithelial cells plays a critical role in intestinal crypt homeostasis via Wnt/β-catenin signaling. Am J Physiol Gastrointest Liver Physiol. 2013 Aug 1;305(3):G241-9. doi: 10.1152/ajpgi.00480.2012. Epub 2013 Jun 6. PMID: 23744737; PMCID: PMC3742857.

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