

PRODUCT DATA SHEET

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Curcumin (high purity) powered by Lipodisq™ Sterile Solution

Nano-formulated aqueous solution: Ready-to-use

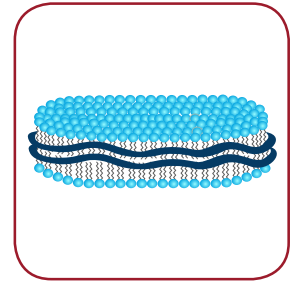
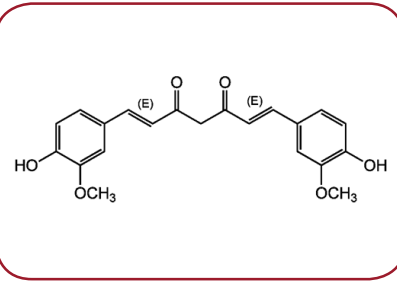
Cat. No.: IAX-700-101

Lot. No.:

Synonyms	1,7-bis(4-hydroxy-3-methoxyphenyl)hepta-1,6-diene-3,5-dione, diferuloylmethane, nano-Curcumin in a detergent-free nano-formulation made of styrene-maleic acid lipid particles (SMALP)
Empirical Formula	C ₂₁ H ₂₀ O ₆
Concentration	0.1% (w/vol) Curcumin in Lipodisq™ corresponds to 271.7µM solution
Size	1ml
MW	368.4
CAS	458-37-7
Purity	≥95% (HPLC). Free of demethoxy- and bis-demethoxycurcumin. Curcumin in Lipodisq™ does not contain any bioactive impurities (usually present in up to 40% in natural formulations of curcumin).
Solution pH	7.00 - 7.50
Solubility	Soluble in water, PBS, Tris and other physiological solutions as formulated in a proprietary, thermostable, aqueous lipid nanoparticulate formulation (Lipodisq™, Malvern Cosmeceutics Ltd., Malvern UK). Avoid the use of buffers with divalent ions such as Ca or Mg or pH <6.5 or >8.0, which can cause particle instability. Unformulated curcumin is soluble in methanol, ethanol, ethyl acetate, acetone, methylene chloride, dimethylformamide or methyl-ethyl ketone and is insoluble in aqueous solutions.
Formulation	Lipodisq™ are nanosized lipid-based discoidal particles that can be manufactured to incorporate hydrophobic, poorly water-soluble compounds, such as lipids, lipoproteins and glycolipids.
Appearance	Orange clear aqueous solution
Handling	Keep sterile. Protect from light. Avoid skin and eye contact.
Activity	Cell culture tested (human macrophage cell line) (MTT). Recommended starting dilution: 1:200 or higher. Optimal working concentrations depend on the applications and need to be determined. Published procedures using Lipodisq™ formulations (Curcumin and IAXO TLR4 antagonists) <i>in vivo</i> rodent models at 3-10mg/kg. Recommended route of administration is subcutaneous (s.c.) with oral or nasal application as a possible alternative, which needs to be optimised. Carrier only control: Lipodisq™ Control Sterile Solution (Cat. No.: IAX-700-100).
Shipping	Ambient
Storage	2-8°C
Stability	For at least 12 months after receipt (unopened and as supplied)
MSDS	Available on request

Document No.: IAX-700-101-TDS | **Version:** 1.3 | **Issue Date:** 16/09/2022

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General Information

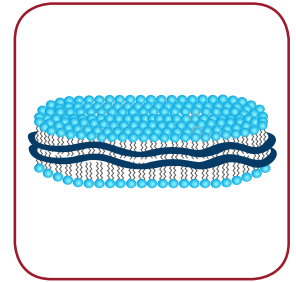
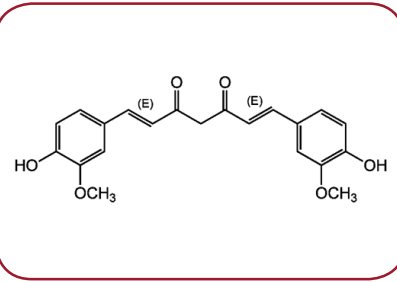
- Curcumin is a yellow pigment present in the spice turmeric (*Curcuma longa*) that has been associated with anti-oxidant, anti-inflammatory, anti-cancer, anti-viral, and anti-bacterial activities. However, curcumin shows poor absorption, biodistribution, metabolism, and bioavailability.
- To increase the bioavailability, enhance circulation, improve permeability and resistance to metabolic processing several formulations of curcumin have been prepared which include nanoparticles, liposomes, micelles, and phospholipid complexes.

Curcumin References

- [1] *Potential therapeutic effects of curcumin, the anti-inflammatory agent, against neurodegenerative, cardiovascular, pulmonary, metabolic, autoimmune and neoplastic diseases.* Aggarwal BB and Harikumar KB. *Int. J. Biochem. Cell Biol.* (2009); 41:40
- [2] *Discovery of curcumin, a component of golden spice, and its miraculous biological activities.* Gupta SC, et al. *Clin. Exp. Pharmacol. Physiol.* (2012); 39:283
- [3] *“Spicing up” of the immune system by curcumin.* Jagetia GC and Aggarwal BB. *J. Clin. Immunol.* (2007); 27:19
- [4] *Immunomodulation by curcumin.* Gautam SC, et al. *Adv. Exp. Med. Biol.* (2007); 595:321
- [5] *Antioxidant and anti-inflammatory properties of curcumin.* Menon VP and Sudheer AR. *Adv. Exp. Med. Biol.* (2007); 595:105
- [6] *Curcumin: an anti-inflammatory molecule from a curry spice on the path to cancer treatment.* Basnet P and Skalko-Basnet. *N. Molecules* (2011); 16:4567
- [7] *Antitumor, anti-invasion, and antimetastatic effects of curcumin.* Kuttan G, et al. *Adv. Exp. Med. Biol.* (2007); 595:173
- [8] *Curcumin as an inhibitor of angiogenesis.* Bhandarkar SS and Arbiser JL. *Adv. Exp. Med. Biol.* (2007); 595:185
- [9] *Neuroprotective effects of curcumin.* Cole GM, et al. *Adv. Exp. Med. Biol.* (2007); 595:197
- [10] *Curcumin and Alzheimer’s disease.* Hamaguchi T, et al. *CNS Neurosci. Ther.* (2010); 16:285
- [11] *Curcumin: a potential neuroprotective agent in Parkinson’s disease.* Mythri RB and Bharath MM. *Curr. Pharm. Des.* (2012); 18:91
- [12] *Targeting inflammation-induced obesity and metabolic diseases by curcumin and other nutraceuticals.* Aggarwal BB. *Annu. Rev. Nutr.* (2010); 30:173
- [13] *Curcumin and obesity: evidence and mechanisms.* Alappat L and Awad AB. *Nutr. Rev.* (2010); 68:729
- [14] *The protective role of curcumin in cardiovascular diseases.* Wongcharoen W and Phrommintikul A. *Int. J. Cardiol.* (2009); 133:145
- [15] *Curcumin-decorated nanoliposomes with very high affinity for amyloid-beta 1-42 peptide.* Mourtas S, et al. *Biomaterials* (2011); 32:1635

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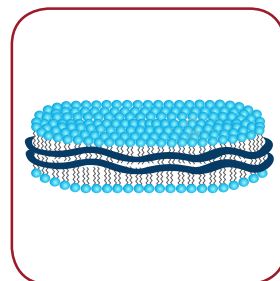
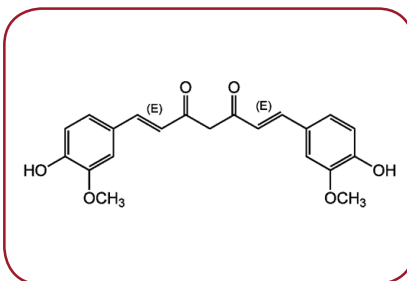
Lot. No.:

Curcumin References

- [16] Novel lipid based oral formulation of curcumin: development and optimization by design of experiments approach. Pawar YB, et al. Int. J. Pharm. (2012); 436:617
- [17] Purely aqueous PLGA nanoparticulate formulations of curcumin exhibit enhanced anticancer activity with dependence on the combination of the carrier. Nair KL, et al. Int. J. Pharm. (2012); 425:44
- [18] Formulation, characterization and evaluation of curcumin-loaded PLGA nanospheres for cancer therapy. Mukerjee A, Vishwanatha JK. Anticancer Res. (2009); 29:3867
- [19] Curcumin inhibits HMGB1 releasing and attenuates concanavalin A-induced hepatitis in mice. Wang C, et al. Eur. J. Pharmacol. (2012); 697:152
- [20] Purely aqueous PLGA nanoparticulate formulations of curcumin exhibit enhanced anticancer activity with dependence on the combination of the carrier. Nair KL, et al. Int. J. Pharm. (2012); 425:44
- [21] Anti-inflammatory activity of curcumin-loaded solid lipid nanoparticles in IL-1beta transgenic mice subjected to the lipopolysaccharide-induced sepsis. Wang J, et al. Biomaterials (2015); 53:475
- [22] Inhibition of homodimerization of toll-like receptor 4 by curcumin. Youn HS, et al. Biochem. Pharmacol. (2006); 72:62
- [23] MD-2 as the target of curcumin in the inhibition of response to LPS. Gradisar H, et al. J. Leukoc. Biol. (2007); 82:968
- [24] Effect of curcumin on circulating interleukin-6 concentrations: A systematic review and meta-analysis of randomized controlled trials. Derosa G, et al. Pharmacol. Res. (2016); 111:394
- [25] Efficacy of curcumin/turmeric on liver enzymes in patients with non-alcoholic fatty liver disease: A systematic review of randomized controlled trials. Mansour-Ghanaei F, et al. Integr. Med. Res. (2019); 8:57
- [26] Nutritional Approach to Non-Alcoholic Fatty Liver Disease (NAFLD): The Available Clinical Evidence. Cicero AFG, et al. Nutrients (2018); 10:1153
- [27] Curcumin and Biochemical Parameters in Metabolic-Associated Fatty Liver Disease (MAFLD). Rózanski G, et al. Nutrients (2021); 13:2654

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Lipodisq™ Technology

- A nanoparticle (11-40nm) drug delivery system comprising a discolidal phospholipid bilayer membrane stabilised by a chaperone molecule annulus.
- Internal properties of the phospholipid membrane support the disposition and stabilisation of drug molecule candidates and preserve the native conformation of membrane molecules.
- The resulting encapsulated actives are rendered water-soluble and specialised for intra-cellular penetration/delivery via endosomal uptake mechanisms.
- Lipodisq™ solutions show a good safety profile and are suitable for *in vitro* and *in vivo* investigations.
- For a customizable biodegradable Lipodisq™ version with a higher concentration of actives or an alternative lipid option, contact Innaxon.

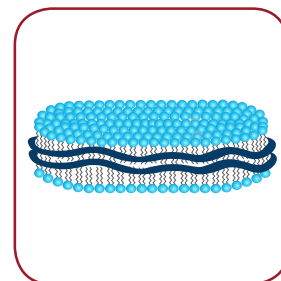
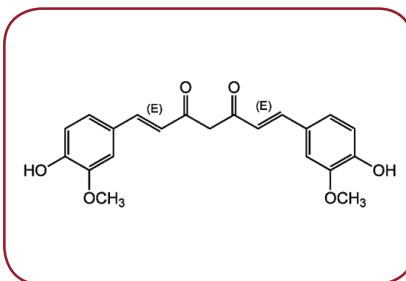
Component	Concentration	CAS #	EC #
Water (sterile)	QS	7732-18-5	231-791-2
Poly(styrene maleic acid)	25mg/ml	26762-29-8	607-996-1
Lecithin	9mg/ml	92128-87-5	295-786-7
Curcumin	1 mg/ml	458-37-7	207-280-5

Lipodisq™ References

- [1] *Mechanisms of Formation, Structure, and Dynamics of Lipoprotein Discs Stabilized by Amphiphilic Copolymers: A Comprehensive Review.* Orekhov PS, et al. *Nanomaterials* (2022); 12:361
- [2] *Applications of Synthetic Polymer Discolidal Lipid Nanoparticles to Biomedical Research.* Tanaka M. *Chem. Pharm. Bull.* (2022); 70:507
- [3] *Understanding the Structural Pathways for Lipid Nanodisc Formation: How Styrene Maleic Acid Copolymers Induce Membrane Fracture and Disc Formation.* Bjørnstad VA, et al. *Langmuir* (2021); 37:6178
- [4] *Physicochemical Characterization, Toxicity and In Vivo Biodistribution Studies of a Discolidal, Lipid-Based Drug Delivery Vehicle: Lipodisq Nanoparticles Containing Doxorubicin.* Torgersen ML, et al. *J. Biomed. Nanotechnol.* (2020); 16:41
- [5] *Effects of charged lipids on the physicochemical and biological properties of lipid–styrene maleic acid copolymer discolidal particles.* Tanaka M, et al. *Biochim. Biophys. Acta. Biomembr.* (2020); 1862:183209
- [6] *From polymer chemistry to structural biology: The development of SMA and related amphipathic polymers for membrane protein extraction and solubilization.* Bada Juarez JF, et al. *Chem. Phys. Lipids.* (2019); 221:167
- [7] *The styrene–maleic acid copolymer: a versatile tool in membrane research.* Dörr JM, et al. *Eur. Biophys. J.* (2016); 45:3
- [8] *Reconstitution of membrane proteins: a GPCR as an example.* Goddard AD, et al. *Methods Enzymol.* (2015); 556:405

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- [9] Nano-size uni-lamellar lipodisq improved in situ auto-phosphorylation analysis of *E. coli* tyrosine kinase using (19)F nuclear magnetic resonance. Li D, et al. *Protein Cell* (2015); 6:229
- [10] Characterizing the structure of lipodisq nanoparticles for membrane protein spectroscopic studies. Zhang R, et al. *Biochim. Biophys. Acta.* (2015); 1848:329
- [11] Advances in the use of nanoscale bilayers to study membrane protein structure and function. Malhotra K and Alder NN. *Biotechnol. Genet. Eng. Rev.* (2014); 30:79
- [12] DEER EPR measurements for membrane protein structures via bifunctional spin labels and lipodisq nanoparticles. Sahu ID, et al. *Biochemistry* (2013); 52:6627
- [13] Detergent-free formation and physicochemical characterization of nanosized lipidpolymer complexes: lipodisq. Orwick MC, et al. *Angew. Chem.* (2012); 51:4653
- [14] Detergent-free incorporation of a seven-transmembrane receptor protein into nanosized bilayer lipodisq particles for functional and biophysical studies. Orwick-Rydmark M, et al. *Nano Lett.* (2012); 12:4687
- [15] In vitro and in vivo evaluation of tumor targeting styrene-maleic acid copolymer-pirarubicin micelles: survival improvement and inhibition of liver metastases. Daruwalla, J, et al. *Cancer Sci.* (2010); 101:1866
- [16] Poly(styrene-alt-maleic anhydride) derivatives as potent anti-HIV microbicide candidates. Fang W, et al. *Bioorg. Med. Chem. Lett.* (2009); 19:1903
- [17] SMA-doxorubicin, a new polymeric micellar drug for effective targeting to solid tumours. Greish K, et al. *J. Control. Release* (2004); 97:219
- [18] Responsive Hydrophobically Associating Polymers: A Review of Structure and Properties. Tonge, SR and Tighe, BJ. *Adv. Drug Deliv. Rev.* (2001); 53:109

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