Product Data Sheet

Product Name: Miraculin (1-20)
Cat. No.: GA23201

Chemical Properties

Cas. No.	198694-37-0		
Formula	$C_{88}H_{146}N_{26}O_{34}$	M.Wt	2112.28
Solubility	Soluble in DMSO	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	Miraculin (1-20)		

Protocol

Cell experiment [1]:

Cell lines	HEK293 cells
Preparation Method	Miraculin was dissolved in HBSS containing 10 mM HEPES, HEK293 cells were treated with Miraculin (10 μg/ml) for 3 minutes.
Reaction Conditions	10 μg/ml Miraculin for 3 minutes

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Applications	Miraculin-applied cells displayed a pH dependence with citric acid (weak acid) being right shifted to that with hydrochloric acid (strong acid). When histidine residues in both the intracellular and extracellular region of hTAS1R2 were exchanged for alanine, taste-modifying effect of Miraculin was reduced or abolished. Stronger intracellular acidification of HEK293 cells was induced by citric acid than by HCl and taste-modifying effect of Miraculin was proportional to intracellular pH regardless of types of acids.

References:

[1]: Sanematsu K, Kitagawa M, Yoshida R, Nirasawa S, Shigemura N, Ninomiya Y. Intracellular acidification is required for full activation of the sweet taste receptor by miraculin. Sci Rep. 2016 Mar 10;6:22807. doi: 10.1038/srep22807. PMID: 26960429; PMCID: PMC4785348.

Background

Miraculin (1-20) is active component of R. dulcifica that modifies or converts sourness to sweetness. Miraculin is a taste-modifying protein that exhibits extremely unusual properties and is famous for its unique taste characteristics [2]. Taste-modifying effect of Miraculin is specific to humans but not to rodents,he role of Miraculin varies among different types of acids[4,7].

The TAS1Rs belong to the class C G-protein-coupled receptor (GPCR) family and consist

of three principal domains: an amino-terminal domain (ATD) and a cysteine-rich domain (CRD) located in the extracellular region and a transmembrane domain (TMD) [6].

Miraculin interacts with the human sweet receptor subunit hTAS1R2. Miraculin-applied cells displayed a pH dependence with citric acid (weak acid) being right shifted to that with hydrochloric acid (strong acid). When histidine residues in both the intracellular and extracellular region of hTAS1R2 were exchanged for alanine, taste-modifying effect of Miraculin was reduced or abolished. Stronger intracellular acidification of HEK293 cells was induced by citric acid than by HCl and taste-modifying effect of Miraculin was proportional to intracellular pH regardless of types of acids. Intracellular acidity is required for full activation of the sweet taste receptor by Miraculin [1□3].

Recombinant Miraculin resembled native Miraculin in the secondary structure and the taste-modifying activity to generate sweetness at acidic pH. Since the observed pH-sweetness relation seemed to reflect the imidazole titration curve, suggesting that histidine residues might be involved in the taste-modifying activity.Both H30A and H30,60A mutants have lost the taste-modifying activity. Histidine-30 residue is important for the taste-modifying activity of Miraculin [5].

References:
[1]: Misaka T. Molecular mechanisms of the action of miraculin, a taste-modifying protein. Semin Cell Dev Biol. 2013 Mar;24(3):222-5. doi: 10.1016/j.semcdb.2013.02.008. Epub 2013 Mar 4. PMID: 23466289.
[2]: Kurihara K, Beidler LM. Taste-modifying protein from miracle fruit. Science. 1968 Sep 20;161(3847):1241-3. doi: 10.1126/science.161.3847.1241. PMID: 5673432.
[3]: Sanematsu K, Kitagawa M, et,al. Intracellular acidification is required for full activation of the sweet taste receptor by miraculin. Sci Rep. 2016 Mar 10;6:22807. doi: 10.1038/srep22807. PMID: 26960429; PMCID: PMC4785348.
[4]: Brouwer JN, Glaser D, et,al. The sweetness-inducing effect of miraculin; behavioural and neurophysiological experiments in the rhesus monkey Macaca mulatta. J Physiol. 1983 Apr;337:221-40. doi: 10.1113/jphysiol.1983.sp014621. PMID: 6875928; PMCID: PMC1199104.
[5]: Ito K, Asakura T, et,al. Microbial production of sensory-active miraculin. Biochem Biophys Res Commun. 2007 Aug 24;360(2):407-11. doi: 10.1016/j.bbrc.2007.06.064. Epub 2007 Jun 19. PMID: 17592723.

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[6]: Kunishima N, Shimada Y, et,al. Structural basis of glutamate recognition by a dimeric metabotropic glutamate receptor. Nature. 2000 Oct 26;407(6807):971-7. doi: 10.1038/35039564. PMID: 11069170.
[7]: KURIHARA, K., BEIDLER, L. Mechanism of the Action of Taste-modifying Protein. Nature 222, 1176-1179 (1969). https://doi.org/10.1038/2221176a0

Miraculin (1-20) [illegible] R. dulcifica [illegible] Miraculin [illegible][2][illegible] Miraculin [illegible]Miraculin [illegible][4,7][illegible]

TAS1R [illegible] C [illegible] G [illegible] (GPCR) [illegible]:[illegible] (ATD) [illegible] (CRD) [illegible] (TMD) [6][illegible]

[illegible] hTAS1R2 [illegible] Miraculin [illegible] pH [illegible] hTAS1R2 [illegible]Miraculin [illegible] HCl [illegible] HEK293 [illegible]Miraculin [illegible] pH [illegible] Miraculin [1[illegible]3] [illegible]

[illegible] Miraculin [illegible] pH [illegible] Miraculin [illegible]pH-[illegible]H30A[illegible]H30,60A[illegible] 30 [illegible] Miraculin [illegible][5][illegible]

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