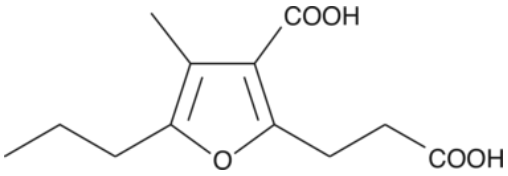
Product Data Sheet

Product Name: CMPF
Cat. No.: GC40478

Chemical Properties

Cas. No.	86879-39-2		
Chemical Name	3-carboxy-4-methyl-5-propyl-2-furanpropanoic acid		
SMILES	CCCc1oc(CCC(=O)O)c(C(=O)O)c1C		
Formula	C12H16O5	M.Wt	240.3
Solubility	30 mg/ml in DMF, 30 mg/ml in DMSO, 30 mg/ml in Ethanol	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

Cell experiment [1]:

Cell lines HK-2 and NRK49F cells

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Preparation Method	Human renal proximal tubular epithelial cells (HK-2) were cultured in Dulbecco's modified Eagle's Medium-F-12 (DMEM-F12) supplemented with 10% fetal bovine serum. Normal rat kidney fibroblasts (NRK-49F) were grown in DMEM medium supplemented with 5% fetal bovine serum, 100U/mL penicillin, and 100μg/mL streptomycin at 37°C under a humidified 5% CO_2 atmosphere. Levels of intracellular ROS were assessed using 5,6-chloromethyl-2′,7′-dichlorodihydrofluorescein diacetate (CM-H2DCFDA). Cells were pretreated with 1μM Ferritin-1 and 1μg/ml Deferoxamine for 1h, treated with 400μM CMPF and incubated in DMEM-F12 serum-free medium for 6h. Cells were washed twice with Hanks' balanced salt solution (HBSS) and incubated with HBSS (without phenol red) containing 10μM CM-H2DCFH-DA for 30min at 37°C. Images were immediately acquired by confocal microscopy on a laser-scanning microscope.
Reaction Conditions	400μM; 6h
Applications	CMPF significantly increased the ROS levels in HK-2 and NRK49F kidney cells.

Animal experiment [2]:

Animal models	CD1 mice and Ob/ob mice

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Preparation Method	CD1 mice were placed on a HFD with 60% kcal from fat or a matched sucrose chow diet with 10% kcal from fat for 6 weeks. Mice were maintained on their respective diets while injected intraperitoneally once daily for 2 weeks with 6mg/kg CMPF or vehicle. CMPF was prepared by dissolving in 70% ethanol to a stock concentration of 100mM and diluted in sterile saline for injection. Ob/ob mice were maintained on a standard chow diet throughout the 2 weeks of intraperitoneal (i.p.) injection with 6mg/kg CMPF or vehicle. Mice were monitored for body weight weekly. At the end of the injection period, i.p. GTTs were performed on mice fasted for 14h overnight. Mice were anesthetized using isofluorane. Total blood volume was collected from the chest cavity following removal of the heart. Tissues were collected and flash frozen in liquid nitrogen for future analysis or fixed in a 4% formaldehyde solution for histology.
Dosage form	6mg/kg/day; 2 weeks; i.p.
Applications	The CMPF treatment increased the fasting blood glucose concentration in the obese mouse model induced by a high-fat diet, aggravated glucose tolerance impairment, and simultaneously led to a decline in β-cell function and an increase in ROS levels.

References:

[1] Park J S, Kim D H, Choi H I, et al. 3-Carboxy-4-methyl-5-propyl-2-furanpropanoic acid (CMPF) induces cell death through ferroptosis and acts as a trigger of apoptosis in kidney cells[J]. Cell Death & Disease, 2023, 14(2): 78.
[2] Liu Y, Prentice K J, Eversley J A, et al. Rapid elevation in CMPF may act as a tipping point in diabetes development[J]. Cell reports, 2016, 14(12): 2889-2900.

Background

CMPF is the main metabolite of furan fatty acids and is a uremic toxin (UT). Under physiological conditions, it is excreted into urine through organic anion transporters [1]. CMPF has a high albumin-binding property, and increasing the serum concentration of competitive binding molecules (such as free fatty acids like oleic acid) may indirectly affect the binding of CMPF to albumin [2]. CMPF is

mainly present in the liver, heart, and brain and participates in metabolic pathways related to cholesterol, fatty acids, and lipid synthesis [3].

In vitro, treatment with CMPF (0-400μM; 0-24h) can dose- and time-dependently reduce the GSH levels and the expression of GPX4, FHC, and FLC in HK-2 and NRK49F kidney cells, and increase ROS levels, lipid peroxidation, and intracellular iron concentration [4]. Treatment with CMPF (87μM; 30min) significantly increased the exposure of phosphatidylserine markers of erythrocytes, the level of $icCa^{2+}$, and the permeability fragility of erythrocytes [5].

In vivo, treatment with CMPF (6mg/kg/day; 2 weeks; i.p.) increased the fasting blood glucose concentration in a high-fat diet (HFD)-induced obesity mouse model, aggravated glucose tolerance impairment, and simultaneously decreased β-cell function and increased ROS levels [6]. Treatment with CMPF (6mg/kg/day; 7 days; i.p.) enhanced the liver lipid clearance rate in the HFD-induced mouse fatty liver model, while inhibiting liver lipid accumulation and insulin resistance [7].

References:
[1] Luce M, Bouchara A, Pastural M, et al. FP322 THE UREMIC TOXIN 3 CARBOXY 4 METHYL 5 PROPYL 2 FURANPROPANOIC ACID (CMPF): PARADOX OF ANEW NUTRITIONAL MARKER IN HAEMODIALYSIS[J]. Nephrology Dialysis Transplantation, 2018, 33(suppl_1): i139-i139.
[2] Lim, C.-F., Stockigt, J.R., Curtis, A.J., et al. A naturally occuring furan fatty acid enhances drug inhibition of thyroxine binding in serum. Metabolism 42(11), 1468-1474 (1993).
[3] Prentice K J, Wendell S G, Liu Y, et al. CMPF, a metabolite formed upon prescription omega-3-acid ethyl ester supplementation, prevents and reverses steatosis[J]. EBioMedicine, 2018, 27: 200-213.
[4] Park J S, Kim D H, Choi H I, et al. 3-Carboxy-4-methyl-5-propyl-2-furanpropanoic acid (CMPF) induces cell death through ferroptosis and acts as a trigger of apoptosis in kidney cells[J]. Cell Death & Disease, 2023, 14(2): 78.
[5] Van Spitzenbergen B A K, Andrade G B, Dias E S, et al. The uremic solute 3-carboxy-4-methyl-5-propyl-2-furanpropionate (CMPF) may enhance eryptosis and increase erythrocyte osmotic fragility through potential activation of PIEZO1[J]. Nephrology Dialysis Transplantation, 2025, 40(7): 1342-1349.
[6] Liu Y, Prentice K J, Eversley J A, et al. Rapid elevation in CMPF may act as a tipping point in diabetes development[J]. Cell reports, 2016, 14(12): 2889-2900.
[7] Mohan H, Brandt S L, Kim J H, et al. 3-carboxy-4-methyl-5-propyl-2-furanpropanoic acid (CMPF)

prevents high fat diet-induced insulin resistance via maintenance of hepatic lipid homeostasis[J]. Diabetes, Obesity and Metabolism, 2019, 21(1): 61-72.