

Cell Biology - Study/Probes

Fluorescent Magnesium Indicators

Magnesium (Mg^{2+}) is an essential ion in cell biology, with usual concentration of 0.1-6 mM. It is involved in enzyme activities (cofactors), muscular contraction, hormonal secretion, DNA synthesis... Measurement may be more difficult than for Ca^{2+} , because of protein binding, and low variations. Available Mg^{2+} indicators are the popular Fura-2 (K_d : 4.7nM), and our new light visible dyes (K_d : 4-5 nM; especially magFluo-4). Lower affinity dyes are Indo-mag (K_d : 2.7mM) and several Ca^{2+} indicators that are useful also for Mg^{2+} .

Standard Mg^{2+} indicator

Fura-2 (Mag-Fura-2) is a UV-excitable ratiometric fluorescent indicator for magnesium with a K_d of 1.9 mM⁻¹ [1,2]. Similar to Fura-2, the excitation wavelength of Mag-Fura-2 undergoes a blue shift from 369 nm to 330 nm. Mag-Fura-2 also responds to Ca^{2+} but with a significantly lower K_d than Fura-2 to Ca^{2+} . An important application of Mag-Fura-2 is its use in detecting high, transient Ca^{2+} concentration during Ca^{2+} spike^{3,4}.

References :

- 1) Pro. Natl. Acad. Sci. USA 86, 2981(1989)
- 2) Am. J. Physiol. 256, C540(1989)
- 3) Neuron 10, 21(1993)
- 4) Biophys. J. 68, 2156(1995)

abs em. Fura-2, AM ester

(Mag-Fura-2, AM)

$C_{30}H_{30}N_2O_{19}$ MW : 722.58

Soluble in DMSO

Store at -20°C and protect from light

$\lambda_{exc.}/\lambda_{em.}$ (hydrolyzed) : see Fura-2 salt (FP-048111)

Membrane-permeant.

Readily hydrolyses in cells in Fura-2 FP-048111.

Description	Cat.#	Qty
Fura-2, AM ester	FP-35374A	1 mg
	FP-35374C	20 x 50 µg

abs em. Fura-2, K salt

(Mag-Fura-2)

$C_{18}H_{10}K_4N_2O_{11}$ MW : 586.69

Soluble at pH > 6

Store at 4°C and protect from light

$\lambda_{exc.}/\lambda_{em.}$ (low $[Mg^{2+}]$) : 369/511 nm ; EC : 22 000 M⁻¹cm⁻¹

$\lambda_{exc.}/\lambda_{em.}$ (high $[Mg^{2+}]$) : 329/508 nm ; EC : 24 000 M⁻¹cm⁻¹

K_d : 19 mM

$\lambda_{exc.}/\lambda_{em.}$ (low $[Ca^{2+}]$) : 369/511 nm ; EC : 22 000 M⁻¹cm⁻¹

$\lambda_{exc.}/\lambda_{em.}$ (high $[Ca^{2+}]$) : 329/508 nm ; EC : 26 000 M⁻¹cm⁻¹

K_d : 25 µM

Membrane-impermeant but can be loaded into cells via microinjection or scrape loading.

Description	Cat.#	Qty
Fura-2, K salt	FP-048111	1 mg

abs em. Fura-2, Na salt

$C_{18}H_{10}N_2Na_4O_{11}$ MW : 522.25

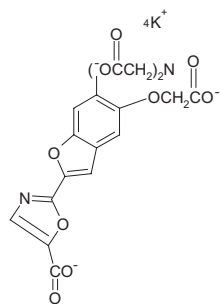
Soluble in water pH > 6

Store at 4°C and protect from light

$\lambda_{exc.}/\lambda_{em.}$: see Fura-2-K salt FP-048111

Membrane-impermeant but can be loaded into cells via microinjection or scrape loading.

Description	Cat.#	Qty
Fura-2, Na salt	FP-AK1681	1 mg



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KMG-20-AM

This Mg^{2+} -selective fluorescent ionophore enables accurate measurement of Mg^{2+} because it has very much low affinity to Ca^{2+} compared to Mg^{2+} .

Applications :

Mg^{2+} -imaging without interference of Ca^{2+} .

Precise observation of Mg^{2+} distribution by Fluorescent Microscopy.

Direct observation of Mg^{2+} ion dynamics in living cells

Description	Cat.#	Qty
KMG-20-AM	BI1030	1 mg

Responses of fluorescence intensity of KMG-20 and Magnesium Green for Ca^{2+} . Arrow indicates the timing of 10 μM $CaCl_2$ addition ($[Ca^{2+}]$ increased from 140 to 850 nm).

References:

Nagashima, H., Tohda, K., Matsunari, Y., Tsunakawa, Y., Watanabe, K., Inoue, H. and Suzuki, K.: Anal. Lett., 23, 1993(1990).

Suzuki, K., Watanabe, K., Matsumoto, Y., Kobayashi, M., Sato, S., Siswanta, D. and Hisamoto, H.: Anal. Chem., 67, 324(1995).

Suzuki, Y., Saito, N., Komatsu, H., Citterio, D., Kitamura, Y., Kubota, T., Oka, K. and Suzuki, K.: Anal. Sci., 17, 11451(2001).

Suzuki, Y., Komatsu, H., Ikeda, T., Saito, N., Araki, S., Citterio, D., Hisamoto, H., Kitamura, Y., Kubota, T., Nakagawa, J., Oka, K. and Suzuki, K.: Anal. Chem., 74, 1423(2002).

Kubota, T., Tokuno, K., Nakagawa, J., Kitamura, Y., Ogawa, H., Suzuki, Y., Suzuki, K. and Oka, K.: Biochem. Biophys. Res. Commun., 303, 332(2003).

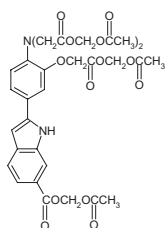


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Low affinity Mg²⁺ indicators

abs em. Indo-Mag, AM (Mag-Indo, AM)

C₃₃H₃₄N₂O₁₇ MW : 730.64

Soluble in DMSO. Store at 4°C and protect from light

$\lambda_{exc.}/\lambda_{em.}$ (hydrolyzed) : see Indo-Mag K salt (FP-326161)

Membrane-permeant Mg²⁺ indicator. Hydrolysis gives the Indo-mag product (FP-326161).

Description	Cat.#	Qty
Indo-Mag, AM (Mag-Indo, AM)	FP-23305A	1 mg
	FP-23505B	20 x 50 µg

abs em. Indo-Mag, K salt (Mag-Indo)

C₂₁H₁₄N₂O₉K₄ MW : 594.76

Soluble at pH > 6, MeOH. Store at 4°C and protect from light

$\lambda_{exc.}/\lambda_{em.}$ (low [Mg²⁺]) : 349/480 nm ; EC : 38 000 M⁻¹cm⁻¹

$\lambda_{exc.}/\lambda_{em.}$ (high [Mg²⁺]) : 330/417 nm ; EC : 35 000 M⁻¹cm⁻¹

K_d : 2.7 mM

$\lambda_{exc.}/\lambda_{em.}$ (low [Ca²⁺]) : 349/480 nm ; EC : 38 000 M⁻¹cm⁻¹

$\lambda_{exc.}/\lambda_{em.}$ (high [Ca²⁺]) : 328/390 nm ; EC : 35 000 M⁻¹cm⁻¹

K_d : 35 µM

Membrane-impermeant Mg²⁺ indicator with similar spectral response as indo-1, but Mg²⁺ specific.

Description	Cat.#	Qty
Indo-Mag, K salt (Mag-Indo)	FP-326161	1 mg

abs em. MagFluo-4, AM

C₃₇H₃₃F₂NO₁₈ MW : 817.67

Soluble in DMSO. Store at -20°C and protect from light

$\lambda_{exc.}/\lambda_{em.}$ (low [Ca²⁺]) : 456 nm/weak

Hydrolyzed product : see MagFluo-4 salt (FP-M2024)

Membrane-permeant Mg²⁺ indicator. Hydrolysis gives the MagFluo4 product (FP-M2024A).

Description	Cat.#	Qty
MagFluo-4, AM	FP-M2025A	500 µg

abs em. MagFluo-4, K salt

C₂₅H₁₃F₂K₄NO₁₀ MW : 681.79

Soluble in water pH>6. Store at 4°C

$\lambda_{exc.}/\lambda_{em.}$ (free) : 490 nm/weak ; EC : 74 000 M⁻¹cm⁻¹

$\lambda_{exc.}/\lambda_{em.}$ (high [Mg²⁺]) : 493/517 nm ; EC : 75 000 M⁻¹cm⁻¹

K_d : 4.7 nm (22 µM with Ca²⁺)

Membrane-impermeant Mg²⁺ indicator with similar spectral responses as Fluo-4, but Mg²⁺ specific.

Description	Cat.#	Qty
MagFluo-4, K salt	FP-M2024A	500 µg

abs em. MagFluo-3, AM

MW : 851

Soluble in DMSO. Store at -20°C and protect from light

$\lambda_{exc.}/\lambda_{em.}$ (low [Ca²⁺]) : 460 nm/weak ; EC : 26 000 M⁻¹cm⁻¹

Hydrolyzed product : see MagFluo-3 salt (FP-BB4240)

Membrane-permeant Mg²⁺ indicator.

Hydrolysis gives the MagFluo-3 product (FP-BB4240).

Description	Cat.#	Qty
MagFluo-3, AM	FP-BB4230	500 µg

abs em. MagFluo-3, K salt

MW : 715

Soluble in water pH > 6. Store at 4°C

$\lambda_{exc.}/\lambda_{em.}$ (free) : 505 nm/weak

$\lambda_{exc.}/\lambda_{em.}$ (high [Mg²⁺]) : 505/525 nm ; EC : 80 000 M⁻¹cm⁻¹

K_d : 5.1 nm

Membrane-impermeant Mg²⁺ indicator with similar spectral responses as Fluo-3, but Mg²⁺ specific.

Description	Cat.#	Qty
MagFluo-3, K salt	FP-BB4240	500 µg

Long wavelength Mg²⁺ indicators.