Product Name: MNI-glutamate **Cat. No. 1490**

The peak absorption is at 340 nm, the quantum yield is 0.085 and photo release following a light pulse has half-time 200 ns. Release of glutamate is stoichiometric with cage consumption during progressive photolysis. One photon photolysis gives about 35% conversion with a 1 ms flash lamp pulse in a typical set-up. With laser photolysis, full conversion in a 1 µm laser spot at 405 nm requires 200 $nJ.\mu m^{-2}$, a 0.1 ms exposure at 2 mW, also showing no phototoxicity at this level. At 355 nm full conversion requires about 20 $\mu J.\mu m^{-2}$; however extracellular photolysis in an upright microscope with 355 nm light is subject to substantial losses due to inner filtering in the bath solution.

MNI-glutamate shows no interference with glutamate receptors or transporters at mM concentration but interferes with synaptic activation of GABA-A receptors with IC50 approx. 0.5 mM. Although stable to hydrolysis and soluble in water at 50 mM, it is often necessary to warm stock solutions of MNI-glutamate after thawing.

Two photon photolysis

Although widely used, the efficiency of two-photon photolysis of MNI-glutamate is low. The TP photolysis cross-section is 0.02 0.06 GM (10^{-50} cm^4.s /photon) at 730 nm, 3 orders less than common fluorophores. For 5 mW, average power and with usual TiS mode-locked laser beam parameters at 730 nm, the two-photon conversion of MNI-glutamate in an excitation volume formed by a 0.9 NA objective requires cage concentrations of 10 mM to generate free glutamate at concentrations that mimic synaptic activation. Exposures are often longer than the optimal 200 µs generate glutamate in a volume larger than the two-photon excitation volume.

For extracellular photolysis avoiding the 'inner filtering effect' of the cage, the alternative of using one photon excitation at 405 nm is substantially more efficient than two-photon excitation.

References

1. Canepari *et al* (2001) The conductance underlying the parallel fibre slow EPSP in rat cerebellar Purkinje neurons studied with photolytic release of L-glutamate. J.Physiol. *533* 765.
2. Canepari *et al* (2001) Photochemical and pharmacological evaluation of 7-nitorindolinyl- and 4-methoxy-7-nitroindolinyl-amino acids as novel, fast caged neurotransmitters. J.Neurosci.Meths. *112* 29.
3. DiGregorio *et al* (2007) Desensitization properties of AMPA receptors at the cerebellar mossy fiber granule cell synapse. J.Neurosci. *27* 8344.
4. Matsuzaki *et al* (2001) Dendritic spine geometry is critical for AMPA receptor expression in hippocampal CA1 pyramidal neurons. Nature Neurosci. *4* 1086.
5. Morrison *et al* (2002) Mechanisms of photorelease of carboxylic acids from 1-acyl-7-nitroindolines in solutions of varying water content. Photochem.Photobiol.Sci. *1* 960.
6. Papageorgiou *et al* (1999) Photorelease of carboxylic acids from 1-acyl-7-nitroindolines in aqueous solution: Rapid and efficient photorelease of L-glutamate. J.Am.Chem.Soc. *121* 6503.
7. Smith *et al* (2003) Mechanism of the distance-dependent scaling of Schaffer collateral synapses in rat CA1 pyramidal neurons. J.Physiol. *548* 245.
8. Trigo *et al* (2009) Laser photolysis of caged compounds at 405 nm: photochemical advantages, localization, phototoxicity and methods for calibration. J.Neurosci.Meths.*180* 9.