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AN EXAMPLE OF ORGANIC SYNTHESIS INDUCED BY LASER IRRADIATION

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Apart from certain rare instances, the synthesis of cyclobutane derivatives must be performed photochemically. If, however, acrylonitrile is used as reagent (e.g. for the synthesis of nitrile function terpenes known for their "green notes"), a parasite polymerisation reaction that prevents the intermolecular reaction, is observed. Since the laser is both a powerful and a monochromatic light source, it is a tool of choice for the selective excitation of a chosen substrate molecule.

Laser irradiation of a carvone solution in acrylonitrile (5% v/v) at about 350nm (i.e. near the absorption maximum of the n-π* transition of the enone) induced a chemical reaction leading to the quasi-quantitative synthesis of cyclobutane derivatives:

\[ \text{hv} \leftrightarrow \approx 350 \text{nm} \]

Carvone + Acrylonitrile \rightarrow Dérivés cyclobutaniques

Two types of laser were used in this study: a Nd-YAG pulsed laser (λ = 355nm, F = 10 Hz, Energy per pulse = 45 mJ max.) and a C.W. Ar laser (λ = 351.1 nm, P = 100 mW).

The quantum yield of the transformation was very high. It was a constant 13% in the 10^{-5}-10^{-1} MW/cm^2 light intensity range. It grew to 30% when the intensity was 6.4 MW/cm^2 and then diminished.