Selective Bond Excision of Nitroimidazoles in Electron Transfer Experiments

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Nitroimidazoles and derivatives have been under investigation especially because of their electron-affinic properties to be used as radiosensitisers in radiation treatments, namely in solid tumours growing in a hypoxic environment [1], and recently two new fluorine-18 labelled 2-nitroimidazole derivatives were successfully prepared to be used as potential PET radioligands for tumour imaging [2]. However, the molecular mechanisms related to the reactions involving nitroimidazoles after irradiation are not fully understood yet. Thus, its understanding means a key step for the development of new radiotherapeutic drugs and treatments.

Here we present a comprehensive investigation on charge transfer experiments yielding negative ion formation in collisions of fast neutral potassium atoms with nitroimidazole and methylated derivative molecules. The anionic fragmentation pattern shows that the decomposition of the precursor parent anion leads to single and multiple bond cleavages of the molecules, and it is slightly different when compared with DEA studies [3,4]. Selective excision of hydrogen atoms from the N_1 position in 4-nitroimidazole (4NI) is completely blocked upon methylation in 1-methyl-4-nitroimidazole (1m4NI) and 1-methyl-5-nitroimidazole (1m5NI). Additionally, only (4NI) and 2-nitroimidazole (2NI) are efficient in selectively producing neutral $OH^{\bullet}$ and $NO^{\bullet}$ radicals in contrast to (1m4NI) and (1m5NI) [5]. The present work contributes to the current need of pinpointing a class of charge transfer collisions that exhibit selective reactivity of the kind demonstrated here, extending to tailored chemical control for different applications such as tumour radiation therapy through nitroimidazole based radiosensitisation.

References

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