Can heterogeneous catalysis change the way we treat cancer?

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Highlights

- Heterogeneous catalysis has the potential to be a game changer in oncology
- Generation of toxic species inside the tumor
- Destruction of key molecules needed for proliferation
- Selective catalyst delivery or selective activation inside the tumor is needed

Abstract

Catalysis is the obvious choice when the goal is to facilitate or to inhibit certain processes in complex reaction environments. Because of this, its huge potential to modify the tumor microenvironment chemistry towards a growth inhibition scenario has been recognized for some time. However, in spite of the exciting opportunities it affords, catalysis remains a scarcely explored tool in oncology, due to the huge challenges involved in developing suitable catalysts and delivering them selectively to a growing tumor.

This scenario could be about to change, thanks to recent developments in this field. A family of catalysts capable of working within the tumor environment has now emerged, enabling a range of new therapeutic strategies based on specific reactions: depletion of molecules key for tumor growth, such as glucose or amino acids, generation of reactive oxygen species in the tumor microenvironment, and fabrication of toxic drugs via de-protection chemistry are some of the possibilities afforded. Even more importantly, different methods to deliver catalysts to the tumor with sufficient selectivity are being actively developed. When this is not possible, on-site catalyst activation methods offer an elegant alternative to confine the catalytic action to the tumor. Last but not least, novel strategies to preserve the active life of the catalyst in a hostile environment teeming with deactivating (e.g. sulfur-containing) molecules are also needed.

In this talk, some of the most recent developments from our laboratory in this field will be presented, and the challenges that must be solved for the application of catalysis in oncology will be discussed.

References

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