Using Graphene Oxide for New Targeted Therapies: Effects on Immune Cells

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Abstract

Graphene oxide (GO) have gathered lots of interest in the last few years due to its extraordinary chemical and physical properties [1,2] and especially because of its good dispersibility in aqueous media [3]. The fields of applications of this nanomaterial range from electronics, optics, energy, and catalysis to biomedicine [4-6]. However, despite a great effort of the scientific community and the intense research activity, not much is known about the possible impact of GO on biological substrates. Notably, as for other nanomaterials, the intrinsic properties and characteristics of GO could have a great influence on its behavior in a biological environment.

The aim of our study was to investigate how the lateral dimensions of the GO sheets could modify their effects towards biological substrates *in vitro*, especially on primary immune cells. For this purpose, we first evaluated whether GO samples constituted of large, small and very small flakes would differently affect primary human or murine primary macrophages. Our data revealed that the more lateral dimensions of GO were reduced, the higher were the cellular internalization and the effects on cellular parameters such as cellular viability, ROS generation or cellular activation. Interestingly, our study also suggested a possible correlation between the particular interaction of GO with the cellular membrane, surrounding and somehow masking it (so called "mask effect"), with the subsequent internalization of graphene sheets and impact on cellular parameters.[7] Tuning the intrinsic properties of GO, and in particular the "mask effect" could render GO suitable for modulating or depleting particular cell populations. Supporting this hypothesis, we recently collected data from cellular viability experiments on human peripheral blood mononuclear cells and murine splenocytes suggesting a different impact of GO not only based on GO size but also on the cellular population considered. These encouraging results, together with the possibility of further targeting specific cells by functionalizing GO could open the way to new graphene-based therapeutic applications.

References

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