Changes in the graphene oxide structure after different sterilization processes

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Nowadays a lot of scientific effort is focused on the development of new materials for the biomedical use (e.g. for tissue engineering [1] and cancer treatment). One of the most promising material in this field is graphene derivative called graphene oxide (GO). GO is a defected graphene (carbon layer with one atom thickness arranged in hexagonal crystal lattice), where defects are the result of reactive oxygen functional groups bonded to the surface. Great interest of GO is due to its physicochemical properties which allow for modifications of GO structure by different biomolecules attachment. This extend possibilities for interaction with different types of cells and tissues. Moreover, GO without any surface modification was found to be nontoxic and biocompatible towards different cell lines, even human mesenchymal stem cells.[2]

One of the crucial aspects of the new materials with biomedical potential is their purity and the standardized methods of their sterilization should be specified. In this study we demonstrate the impact of different sterilization methods on GO structure and their possibilities to be used before apply to the biological materials (to have contact with cells, tissues, etc.).

Here we show the results of few sterilization methods of GO and indicate which of them are destructive and which can be used without causing changes in this carbon material. Due to large sensitivity of GO on temperature and reducing environment, different mechanisms of action of these methods may indicate some changes on GO surface. We took under examination the following methods: Gamma radiation, high-energy electron beam radiation, tyndallization, sterilization in steam autoclave under two different conditions, sterilization in microwave autoclave. For every experiment we used liquid suspension of graphene oxide produced by modified Marcano [3] method. After each process we conducted FTIR and Raman spectroscopy and analyzed materials with the use of combustion elemental analysis.

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References

[1] Dozois, M. et al., Carbon, 120 (2017) 338-349
[2] Duran, M. et al., Curr Mol Med., 17 (2017) 619-626
[3] Marcano, D. C. et al., *ACS Nano*, 4 *(2010)* 4806–4814.

Figures

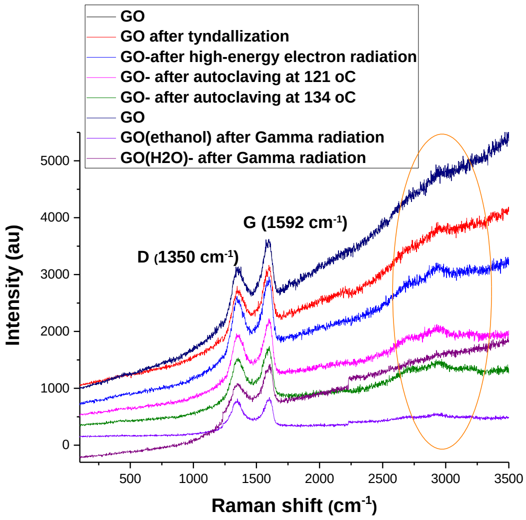

Figure 1: Raman spectra for GO samples sterilized in different ways (described in legend)