NEXT GENERATION TOOLS IN mRNA PURIFICATION: THE ROLE OF CONTINUOUS RAMAN SPECTROSCOPY TESTING WITH PRETREATMENT OF THE SAMPLE

1* Luisetto M., 2 Nili B. Ahmadabadi, 3 Khaled Edbey, 4 Riccardo Benzi Cipelli and 5 Oleg Yurevich Latyshev

1 IMA Mariinskaya Academy Industrial and Applied Chemistry Branch, Professorship General Toxicology Italy 29121.
2 Medicinal Chemist, Nano Drug Delivery, (a Product Development Firm), United States.
3 Professor of Physical Chemistry, Libyan Authority for Scientific Research.
4 IMA Maiinskaya Academy Italy.
5 IMA President RU.

ABSTRACT

In biopharmaceutical productions field the purification process is a crucial step in order to obtain. Drugs with impurity profile according the regulatory agency requirement. Aim of this work is to verify some relevant and recent literature and after analysis to submit to the researcher new Solutions in order to improve the global safety and the toxicological profile: is is submitted a project related the in continuous testing of the purified materials using Raman spectroscopy – with pretreatment of the sample.

KEYWORDS: mRNA, Purifications, chromatography, separations, columns, resins, monoliths, activated carbon, Raman spectroscopy, pretreatment of sample, continuous testing systems.

INTRODUCTION

In various biopharmaceutical productive process the final purification is a relevant step and are used in example various chromatographic process using different systems (resins, columns, monoliths).

Various materials are used for the stationary phase.
Some vials of mRNA vaccine was analyzed by independent researcher in order to verify the profile of impurity.\textsuperscript{[1]}

Many classic and biological drugs use activated carbon for purification of water needed (pirogen) and in commerce there are producers that use composite materials in their monoliths (carbon based).\textsuperscript{[2],[3]}

In recent time great public debate was involved in finding of graphene like particle in some C19 vials of vaccine as well as in blood of many vaccinated people.\textsuperscript{[4]}

According regulatory agency it is accepted RAMAN spectroscopy also direct to verify impurity in the pharmaceutical product.

But this method (The Direct One Assay), when applied to nanolipids, according literature is not the best way to test the payload of the nanoparticle.\textsuperscript{[6]}

To increase the possibility to find all impurity it is crucial to pre treat the sample (nanolipids) with solvent before preform the RAMAN test.

**MATERIAL AND METHODS**

With an observational point of view some relevant literature is reported and an hypothesis of work is then submitted to increase the global safety related some impurity for the nanolipids based drugs production.

**RESULTS**

From literature: As reported in reference from 1 to 7.

“Because in various API manufacturing process are used AC products it is necessary to test the final impurity also for graphene: this is due by the different size of the particle of amorphous AC vs crystalline exfoliated graphene. (also for genotoxicity) and the toxicity that can be produced also below the threshold for impurity.

The AC production can imply really high temperature with chemico – physical change.

The pharmacopeia monography for AC not cite the word graphene.”\textsuperscript{[8]}

Experimental project hypotesys
In order to increase the power of detecting impurity in nanolipids drugs it is necessary at the end of the production process to test in continuous way the final product using RAMAN spettroscopy (with pretreatment of the sample).

In this way only after use of solvents it is possible to avoid the interference played by the nanolipids.

DISCUSSION

In literature is reported the crucial role played by the purifications steps various cromatografic procedure are used, using resins and monoliths some producers use activate carbon composite materials for production of water for injectabel (PIROGEN) are used also charcoal filter systems membrane the test for PAT (PROCES ANALITYCAL TECHNOLOGY) analysis in pharmaceutical production use also RAMAN SPETTROSCOPY.

This allowed by regulatory agency the direct testing whit RS (without preteratment with solvent of the sample).

This method is not the best to test the payloads for nanolipids drugs. According Vanden-Hehir S, et al. “A major advantage of Raman is that it allows direct imaging of the nanocarriers, and not the payload en-capsulated within them.”

Independent researcher finded grapheme like particle in some vials of some C19 vaccine\cite{1}

Other researcher finded graphene particle in blood of vaccinated.\cite{4}

From membrane of activated carbon can be released impurity One method to produce water for injection (pirogen remove) is using activated carbon.

(The same in order to remove pirogen form inyectable).

Activated charcoal is produced also using really high temperature and it can exfoliate grafite and graphene\cite{8} even if under the thereshold requirement of the regulatory agency.

In monography of activated carbon of vatious pharmacopeia the term graphene is not reported.
CONCLUSION

For all reported in discussion i is opinion of the authors that to increase the level of safety IN mRNA PRODUCTION and purifications it is necessary to test the final product in biopharmaceutical production in continuous way using a RAMAN SPETTROSCOPY With pretreatment of the sample with solvent. This to avoid interference played by the nanolipids.

Also for the classic chemical drugs and their productive process it is of interest to verify the absence of impurity form activated carbon membrane used related the level today admitted (thresholds) by pharmacopeia.

What are the toxicological effect played by some impurity if present in drugs final product also under the regulatory thresholds?

The mRNA purifications steps can be improved using new technology, classic chemical analytical tests whit pre treatement of the samples and performed in continuous way.

CONFLICT OF INTEREST: No.

REFERENCES

4. Dark -Field Microscopic Analysis on the Blood of 1,006 Symptomatic Persons After Anti-COVID mRNA Injections from Pfizer/BioNtech or Moderna International Journal of Vaccine Theory, Practice, and Research, 2022-08-12 | Journal article. DOI: 10.56098/ijvtr.v2i2.47. CONTRIBUTORS: Riccardo Benzi Cipelli; Franco Giovannini; Giampaolo Pisano.
7. Activated charcoal BP monography.
8. AMORPHUS SUBSTANTIE (ACTIVATED CHARCOAL) AND OTHER IMPURITIES IN API MANUFACTURING PROCESS. PHARMACEUTICAL, TOXICOLOGICAL AND REGULATORY IMPLICATION WJPR LUISETTO M ET AL, 2023.