Data Article

Dataset on cytotoxicity effect of polyethylenimine-functionalized graphene oxide nanoparticles on the human embryonic carcinoma stem cell, NTERA2 cell line

Zahra Sadeghi, Parichehr Maleki, Seyed Abolghasem Mohammadi Bondarkhilli, Mehdi Mohammadi, Jamshid Raheb*

National Institute of Genetic Engineering and Biotechnology, Tehran, Iran

A R T I C L E   I N F O

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A B S T R A C T

The data provided in this article are related to research entitled “Efficiency of graphene oxide nanoparticles as delivery system of SOX2OT siRNA”. In this research, the goal is to use PEI-functionalized graphene oxide (PEI-GO) as a carrier for SOX2-OTsiRNA delivery. In this article describes how GO coated with PEI and it was tested whether it can be siRNA carrier in NTERA2? Can it absorb siRNA? Whether Go-PEI affects the viability of NTERA2 (NT2: human embryonic carcinoma stem cell), and HeLa cell lines. In this experiment, graphene oxide nanoparticles functionalized with a polycationic polymer, polyethylenimine (PEI). GO-PEI formation was verified with DLS, FTIR tests and zeta sizer. siRNA absorption ability of GO-PEI was tested by gel retardation assay in various weight ratios of GOPEI/siRNA (GOPEI weight/siRNA weight) (w/w ratio). The cell lines were treated with different concentrations of GO-PEI nanoparticles for 24 and 48 hours. Also, the NT2 cells were treated with different concentrations of GO-PEI nanoparticles and PEI for 36 hours. Cytotoxicity of GO-PEI were investigated by calculating the percent of cell survival by MTT assay. MTT data analyzed in excel. Researchers, who want to

* Corresponding author.
E-mail address: Jam@nigeb.ac.ir (J. Raheb).

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research on different drugs, could transfer the drug to NT2, HeLa and other cancer cells on GO-PEI (concentration 0 up to 100 mg/L). © 2019 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

### Specifications Table

| Subject | Cancer Research, nanotechnology |
|---------|----------------------------------|
| Specific subject area | Relationship between nanoparticles and cell viability, ability of GO-PEI for siRNA absorption |
| Type of data | Chart, Graph, Figure |
| How data were acquired | surface optimizing of GO nanoparticle was done by PEI. then nanoparticle size, the surface electrical charge and chemical properties of GO-PEI nanoparticle were observed by DLS test, zeta sizer and FTIR spectroscopy; The cytotoxicity of GO-PEI nanoparticle was measured using MTT assay by using ELISA reader. Data was analyzed in excel. |
| Data format | Analyzed |
| Parameters for data collection | Cell culture should be sterile surface optimizing of GO with PEI should be done gently and carefully. |
| Description of data collection | For DLS test, GO-PEI were taken to Pasteur Institute of Iran. FTIR done in co-facility lab of National institute of Genetic Engineering and Biotechnology (NIGEB) and MTT by using ELISA reader. In MTT, each dilution had three replications. ELISA reader, read absorption of samples. Then the data were acquired by statistical analyses of absorptions in excel e.g. average, error bar and t-test. |
| Data source location | Institution: National institute of Genetic Engineering and Biotechnology |
| Country: Iran |
| City: Tehran |
| Data accessibility | The data are provided within the article |

### Value of the data

- Since the graphene nanoparticle has a large Surface-to-volume ratio, it can be used for delivery of high amounts of drugs to the cell and even molecular tracking. Also, by surface optimizing, it can be used as an efficient gene carrier.
- Researchers, who want to research on different drugs, could transfer the drug to NT2, HeLa and other cancer cells on GO-PEI.
- presented Data show cytotoxicity effect of various dilutions of GO-PEI on NT2 and Hela cancer cell lines, which can used to various research objectives.
- These data alongside other studies on Nano carriers indicate, different nanoparticles can tested as a better vector for the drug.
- In fact, by choosing nanoparticles as nucleic acid carriers, safer or cheaper and sufficient vectors could be obtained.
- These article alongside other studies on Nano carriers shows how appropriate W/W can be chosen to transfer nucleic acid by the nanoparticle.

### 1. Data

This article contains the data of surface optimizing of graphene oxide nanoparticles by branched Polyethylenimine. There is also information about the size and electrical features of the coated nanoparticles. As the main part, data about the influence of various dilutions of coated nanoparticles, GO-PEI, on NT2 cell survival can be observed. In addition, ability and capacity of GO-PEI nanoparticles in siRNA absorption as a vector is demonstrated. These data showed GO-PEI (0–100mg/L) is not toxic for NT2 and HeLa cells. Therefore, it can be applicable for a drug or siRNA delivery to research goals or medical application in the future.
Fig. 1 illustrates Size and zeta potential Tests (DLS) of coated nanoparticle, GO-PEI. Zeta potential indicates the surface electrical charge of the nanoparticle is positive (Fig. 1. Left). It was also confirmed by DLS that the GO-PEI size remains on a nanoparticle scale (Fig. 1. Right).

Fig. 2 shows the chemical characteristics of prepared GO-PEI and GO that was indicated by FT-IR spectroscopy.

Fig. 3 demonstrates Gel Retardation Assay of GOPEI-siRNA complexes in various W/W ratios. We compared the mass ratio of the GOPEI to siRNA from 0 to 220 by gel retardation assay. This Figure indicate in which the W/W ratio, GOPEI are saturated by siRNA and carry out the maximum amount of siRNA. In this Figure, we showed that GOPEI in the W/W = 200 are saturated by siRNA. SiRNA band appeared when W/W < 200. This assay indicated that increasing of W/W ratio increase amount of drug carrying.

Fig. 4 shows cytotoxicity of GO and GOPEI on NT2 cells. In other word, compares survival charts of NT2 cell line in treatment with different nanoparticle concentrations and also in different treatment.
times for GO and GOPEI. There is no significant differences between control and samples by t-test analysis except in 100mg/l in 24h treatment.

In Fig. 5 compare survival charts of HeLa cell line in treatment with different GO-PEI dilutions and also in different incubation times. There is no significant differences by t-test analysis. In other word, this fig. shows cytotoxicity of GOPEI on HeLa cell line.

Eventually Fig. 6 shows the cytotoxicity effect of PEI and GOPEI on NT2 cells in 36 hours treatment with different nanoparticle concentrations.

2. Experimental design, materials, and methods

2.1. Functionalization of graphene oxide nanoparticles

Nanoparticles are known as a good drug delivery system [1]. Hence we chose graphene oxide nanoparticles for siRNA delivery. In order to get a positive charge on the nanoparticles surface that attracts siRNA through electrostatic interaction, the nanoparticle linked to PEI (branched, average MW~25,000 by LS, average Mn10,000 by GPC, Sigma-Aldrich, St. Louis, MO, USA).

- For surface optimizing of Graphene oxide, it was coated with PEI. For this purpose 10 ml of PEI solution (10 mg/ml) added to 10 ml of GO solution (1 mg/ml) gently. Then it was ultra-sonicated for 10 minutes, followed incubation one night on the stirrer. Then was rinsed 3 to 5 times with deionized water. Finally, we prepared different dilutions from the nanoparticles for cellular testing [2].

2.2. Characterization of GO-PEI nanoparticles

1. Size and zeta potential Tests (DLS)

To verify the accuracy of the PEI coating, we confirmed the positivity of the nanoparticle electrical charge by zeta potential (Fig. 1, left). It was also confirmed by the GO-PEI size test that nanoparticle size remains on a nanoparticle scale (Fig. 1, right).
Fig. 4. Survival percent comparison of NT2 Cell line in Treatment with Different Nanoparticle Concentrations. *P < 0.05.
2. FTIR spectroscopy

The chemical characteristics of prepared GO-PEI and GO was confirmed by FT-IR spectroscopy (Fig. 2).

2.3. Gel retardation assay

Gel retardation assay or band shift assay is a common affinity electrophoresis technique used to study material–nucleic acid interactions. In this test if a protein or other material is capable of binding to a given nucleic acid, the band shift above. In our test siRNA/GOPEI interaction would cause siRNA BAND is not appear.
2.4. Cell culture and MTT cell viability assay

The cell lines (HeLa and Nt2) were cultured in DMEM supplemented with 10% FBS in a humidified incubator with 5% CO2 at +37 °C. The cells were cultured first in a T25 flask and then seeded in a 96-well plate for MTT assay. The MTT method is briefly summarized as follows: In each well of the 96 well plate was seeded about 10,000 cells from the NT2 or HeLa cell line and placed in an incubator for 16 hours. Then we treated the cells of each well with GO-PEI and GO at a specific concentration (dilutions of 0, 0.1, 1, 10, 100 μg/ml respectively). Each dilution had three replications. After 24 hours, the medium cell are removed and the media containing MTT (dimethylthiazole-2 and 5-diphenyl tetrazolium bromide) is added to the cells and placed in the incubator for 2–4 hours in the dark. Then remove the MTT solution and add 100 μl DMSO to each well. To dissolve the Formazan crystals in DMSO, shaked the 96-well plat. The blank well was contained 100 μl DMSO. Absorption of samples at 580 nm is read by the ELISA reader. The test also repeated for 48 hours treatment. Also, with this way, the NT2 cells were treated with different concentrations of GO-PEI nanoparticles and PEI for 36 hours.

Percentage of live cells = Average absorption of treated samples / average absorption of control samples × 100

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104487.

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