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Preparation of GO-Berberrubine Nanocomposite and its Anticancer Activity

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Abstract: Preparation and characterisation of Graphene Oxide (GO)-berberrubine nanocomposite has been developed and the prepared nano materials have been employed for bio-testing in HT29 human colon cancer cell line. From the experimental evaluation it was found that the prepared nano materials showed more enhanced anticancer activity over berberrubine, biologically active isoquinoline alkaloids.

Keywords: Graphene Oxide, Berberrubine, Nanocomposite, Anticancer

Introduction

Graphene is a two-dimensional honeycomb allotrope of carbon [1-2]. When graphene is oxidised by strong oxidising agent [3] then different oxygen-containing group are introduced in the basal plane of it leading to the formation of grapheme oxide (GO) is a newly developed nanomaterial (Figure 1) and is employed in deferent application such as different nano-electronic devices [4-5] and also in medicinal nano-biotechnology and in drug delivery system [6-7]. It was reported that Graphene Oxide (GO) enhanced the bioactivity of some biologically active compound due to its large surface area and increased water solubility [6-7]. In this dissertation, we are trying to observe the enhancement of biological activity of berberrubine, is an isoquinoline alkaloids isolated from *berberis vulgaris* [8]. Berberrubine itself shows antibacterial and anticancer activity in different cancer cell lines.

Materials and Methods

Preparation of GO and GO-berberrubine nanocomposite

Commercially available Graphite powder was oxidized by the modified Hummers method [3]. In this method $KMnO_4$ was used as oxidizing agent in presence of H_2SO_4 and $NaNO_3$. The prepared GO was dissolved in DI water by ultra-sonication and then commercially available berberrubine was added to it. Then the mixture was sonicated for further 30 minutes followed by drying to furnish the desired nanocomposite.

Bio-assay of the berberrubine and GO-berberrubine nanocomposite

Berberrubine and GO-berberrubine nanocomposite solution were prepared separately in DI water by sonication in different concentration (μg/ml) and used for bio evaluation in human HT29 colon cancer cell line.

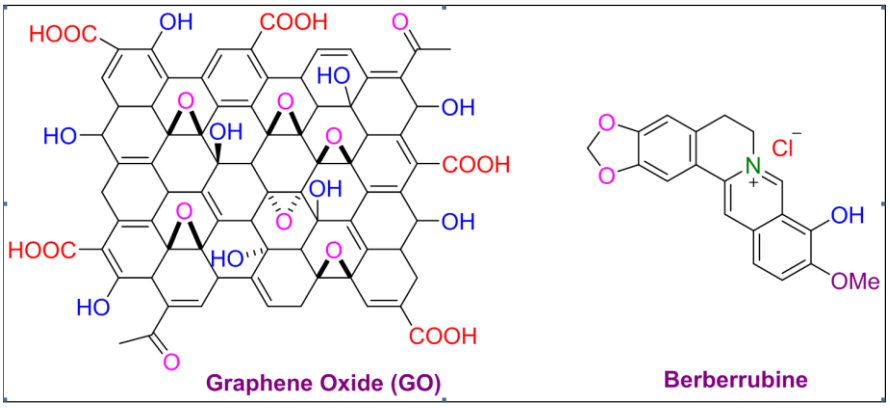

Figure 1. Structure of GO and Berberrubine

Results and Discussion

In this regard, we prepared GO-berberrubine nanocomposite, and a preliminary synergistic anticancer activity has been observed towards the HT29 colon cancer cell line. In a typical method, GO and berberrubine in deionised (DI) water were taken together and sonicated for 30 minutes followed by drying the solvent resulting the desired nanocomposite for bio-testing. Bio-assay *in vitro* revealed that anticancer activity of the GO-berberrubine nanocomposite enhanced 20-30% w.r.t berberrubine alkaloids (Figure 2a). Probably this is because of larger surface area of GO synergise the effect of berberrubine present in the composite.

The prepared nanocomposite was characterised by SEM, TEM, and IR spectroscopy. SEM image (Figure 2b) shows the morphology of the prepared nanocomposite and the TEM image (Figure 2c) revealed that the size of the nanocomposite is nearly 20nm. Formation of the composite was established from the IR spectroscopic comparison between berberrubine (Figure 2d) and GO-berberrubine nanocomposite (Figure 2e).

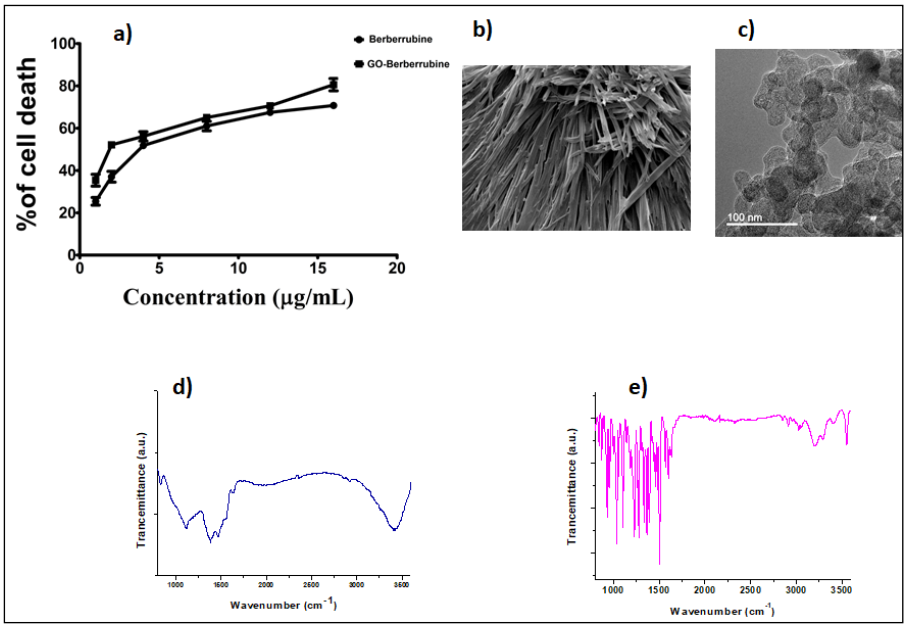

Figure 2. a) Bio-assay of berberrubine and GO-berberrubine nanocomposite, b) SEM image of GO-berberrubine nanocomposite, c) TEM image of GO-berberrubine nanocomposite, d) IR of berberrubine, e) IR of GO-berberrubine nanocomposite.

Conclusion

In conclusion GO-berberrubine nanocomposite has been prepared in greener way and the prepared compound has been employed for anticancer activity. From the bio assay a preliminary observation was established that the nanocomposite showed an enhanced activity over the berberrubine alone.

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