

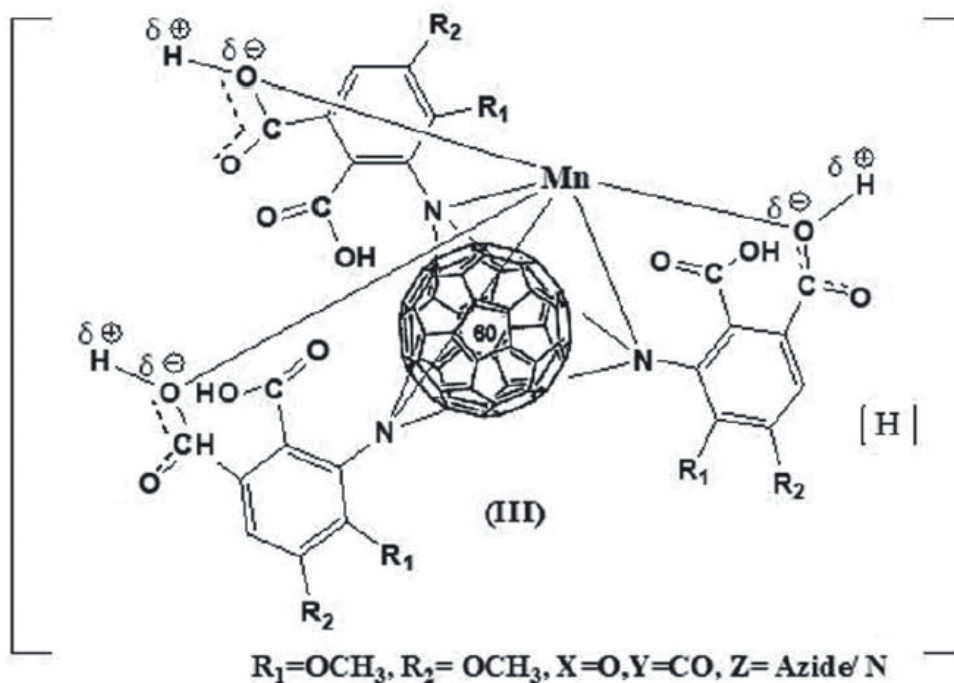
# Water soluble Nanocarbon Materials

## Fullarazirman

Name: s-Tri-(1-aziridino-2, 3-dimethoxy-benzene-5-carboxylato-6-carboxylic acid)-H-Fullerene-C60-Manganese (II) complex has been given a common name, "Fullarazirman" derived from Fullerene + aryl + aziridine + Manganese.

Its anti-cancer activity has been evaluated and found to be comparable to that of Doxorubicin, the most commonly used anti-cancer drug, which is known to have many side effects, including Doxorubicin's cardiotoxicity.

## Chemical Structure



## Sectors of Application

- Medicine- as anti-cancer drug

## Summary

In 2017, a publication from Oxford University emphasized that Water Soluble Fullerenes will enter the market very soon. Fullerenes are also efficient Radical Oxygen Scavengers. Nasal sprays and drinking water (with 0.002%) of such adducts are already in use! Medical value may extend to potential use in treatment of:

- Arthritis
- Parkinson's disease
- Dementia
- HIV-AIDS
- Influenza

These should help entry of nano-medicine and for slow release, better targeted drugs. These new conjugates and adducts should overcome the major limitations of nanocarbon materials, viz. insolubility in most common solvents. Moreover, soluble nanocarbon adducts are also less toxic.

### Additional Information

- Review article entitled “Water Soluble Nanocarbon Materials: Panacea for All” published in the May, 2018 issue of *Current Science*.
- Paper entitled “Fullerazirman” Nano Water Soluble Fullerene C60-Manganese (II) Tri-Adduct Complex with Anti-Cancer Activity Comparable to Doxorubicin, published in the *Journal of Biomedical Nanotechnology*, 2020.
- Indian Patent application has been assigned to RCB, DBT (Govt. of India)

### Water soluble nanocarbon materials: Single Walled Carbon Nanotubes (SWCNT)

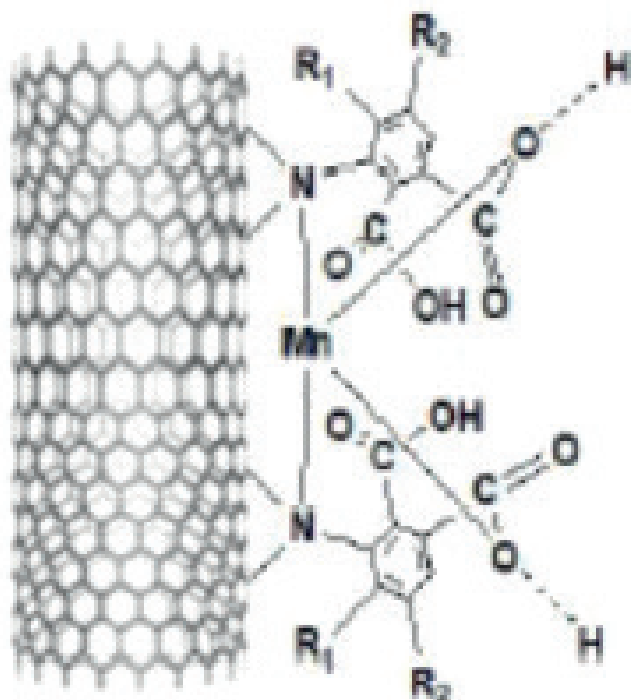
#### Name

s-Tri-(1-aziridino-2, 3-dimethoxy-benzene-5-carboxylato-6-carboxylic acid)-H-SWCNT  
-Manganese (II) complex

#### Status

Available for development and commercialization

### Chemical Structure



## Sectors of Application

- Application in Agriculture
- Application in anti-cancer drug development
- Material science

## Summary

A rare water soluble SWCNT-aryl aziridino-decorated with carboxylic acid groups-Mn (II) complex (III) has been isolated. To the best of our knowledge, this is the first report of its kind, where a single central metal ion of Mn (II) is complexed through carboxylic acid groups and aziridino-nitrogens to SWCNT. Successful functionalization was confirmed by UV-Vis, FT-IR and Raman spectroscopy. Further confirmation was obtained by TEM, Cyclic Voltammetry (CV) and more particularly by Electron Paramagnetic Resonance (EPR) spectroscopy. The availability of such water soluble adducts of NCMs is expected to help boost their industrial use. Application of this new SWCNT-Mn (II) complex (III) on the model plant system, *Arabidopsis thaliana*, led to increased growth of root lengths.

This work could be extended to other plants and other model systems, namely *C. elegans* and *Drosophila melanogaster*. This new material could also lead to the SWCNT drug/ antibody conjugates for 'targeted' drug delivery (e. g. SWCNT-Doxorubicin adduct for treatment of cancer).

Similarly, these could also find uses in material science.

## Water soluble Reduced Graphene Oxide-Manganese (II) Complex

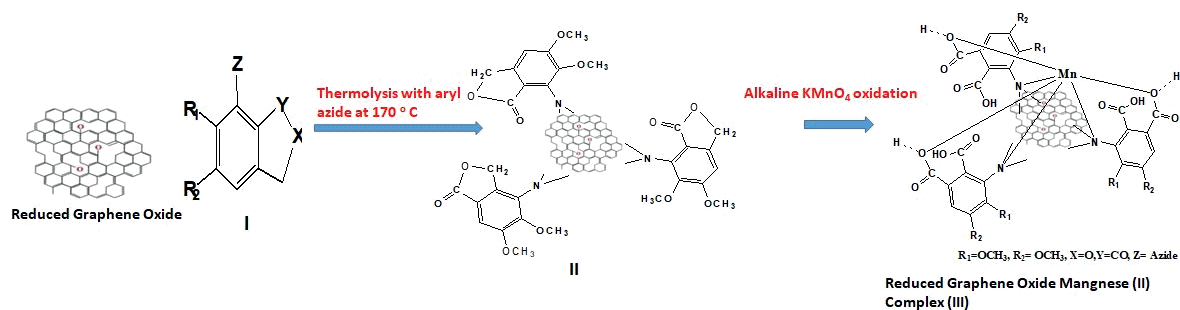
The anti-cancer activity of the new Water-soluble Reduced Graphene Oxide-Manganese (II) Complex has been evaluated and found to be comparable to that of Doxorubicin, the most commonly used anti-cancer drug, which is known to have many side effects, including cardio toxicity.

**Name:** s-Tri-(1-aziridino-2, 3-dimethoxy-benzene-5-carboxylato-6-carboxylic acid)-H- rGO -Manganese (II) complex

## Status

Available for development and commercialization

## Chemical Structure



## Sectors of Application

- Medicine, as anti-Cancer drug

## Summary

Shows potential for activity against breast cancer.

## Additional Information

- Prov. Indian patent application no. TEMP/E-1/35812/2022-DEL dated 03 June, 2022.
- 2. Sujeet Kumar Thakur, Riya Ghosh, Kishan Kumar Gaur, Prasenjit Guchhait, Sambasivan Venkat Eswaran, Anti-cancer Activity of Water-Soluble Reduced Graphene Oxide-Aryl Arizidino-Manganese (II) Complex, *J. Biomed. Nanotechnol.*2022 (In press)