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Data Article

Nitric oxide, DPPH and hydrogen peroxide radical scavenging activity of TEMPO terminated polyurethane dendrimers: Data supporting antioxidant activity of radical dendrimers

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ABSTRACT

This article describes free radical scavenging activity of TEMPO (2, 2, 6, 6-tetramethylpiperidin-1-yloxyl) radical functionalized dendrimers of generation G0 - G4 against nitric oxide (NO), 1, 1-diphenyl-2-picrylhydrazyl (DPPH) and hydrogen peroxide (H_2O_2) radicals. The total antioxidant activity of the dendrimers was also reported and compared with pure 4-hydoxy TEMPO (constituent of dendrimers) and ascorbic acid (vitamin C) standard. The activity of TEMPO functionalized G4 dendrimer against scavenging of nitric oxide and hydrogen peroxide radicals was found comparable to vitamin C. The data presented in this article supports the good antioxidant activity of the dendrimers newly reported in our previous publication (Radical dendrimers: Synthesis, anti-tumor activity and enhanced cytoprotective performance of TEMPO free radical functionalized polyurethane dendrimers).

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Specifications Table

Subject	Materials science
Specific subject area	Biomaterials
Type of data	Table, Graph
How data were acquired	Data were generated using UV−Vis spectrophotometer (Agilent 8453 UV−Vis diode array spectrophotometer) and standard experimental procedures.
Data format	Statistically analysed data in the form of Table and Figure.
Parameters for data collection	Free radical scavenging capability of TEMPO functionalized dendrimers against nitric oxide radical (NO), DPPH radical and hydrogen peroxide as well as total antioxidant activity of dendrimers were examined at 200μg/mL concentration of each sample.
Description of data collection	Data on antioxidant activity of radical dendrimers against different radical species were collected according to reported procedures [2–5] and compared with Vitamin-C.
Data source location	Department of Polymer Science, University of Madras, Guindy Campus, Chennai-600 025, India.
Data accessibility	Data are available with the article
Related research article	B. Mohamad Ali, B. Velavan, G. Sudhandiran, J. Sridevi and A. Sultan Nasar. Radical dendrimers: Synthesis, anti-tumor activity and enhanced cytoprotective performance of TEMPO free radical functionalized polyurethane dendrimers. *Eur. Polym. J.,* doi.org/10.1016/j.eurpolymj.2019.109354.

Value of the Data

- The data represent free radical scavenging capability of synthesised radical dendrimers and are basis for therapeutic evaluation of the compounds.
- Researchers studying oxidative stress in the cellular system and age related disease can benefit from these data.
- These data will be useful for the development of anti-aging drugs for age related disease through therapeutic evaluation.

1. Data description

Free radicals excessively produced in the human body systems damage the cell components including lipids, proteins and DNA; the damage of DNA can lead to the development of cancer and other diseases [1]. Antioxidants are used to reduce the risk of cell damage and cell death. In this article, the scavenging efficiency of TEMPO functionalized polyurethane dendrimers of generation G0 - G4 against nitric oxide (NO), hydrogen peroxide and DPPH radicals and total antioxidant power of the dendrimers were analysed and the data were compared with the activity of constituent 4-hydroxy TEMPO and with a standard vitamin C (Table 1), (Fig. 1). The data clearly indicated that these dendrimers are more potential compared to 4-hydroxy TEMPO in scavenging the free radicals at a concentration of 200μg/mL, i.e., the activity of TEMPO was significantly enhanced when it was conjugated with polyurethane dendrimers. Also, the data revealed that the antioxidant efficiency of dendrimers was increased with increasing the generation number of dendrimers and in the case of nitric oxide radical and hydrogen peroxide, the activity of G4 dendrimer was found comparable to the standard vitamin C.

Table 1
Free radical scavenging activity of TEMPO functionalized polyurethane dendrimers.

Dendrimer	Scavenging activity (in %) on			Total antioxidant activity (Absorbance at 700 nm)
	Nitric oxide radical	DPPH radical	Hydrogen peroxide	
G0	59.59 ± 0.61	51.67 ± 2.42	45.42 ± 2.70	0.28 ± 0.009
G1	59.89 ± 0.19	53.61 ± 1.52	67.84 ± 5.33	0.30 ± 0.02
G2	61.84 ± 0.61	59.11 ± 2.79	75.22 ± 2.34	0.33 ± 0.01
G3	70.87 ± 0.30	62.56 ± 1.34	79.05 ± 3.35	0.65 ± 0.01
G4	71.63 ± 0.34	68.71 ± 3.24	86.43 ± 2.22	1.24 ± 0.58
4-Hydroxy TEMPO	55.42 ± 0.38	43.36 ± 3.08	28.31 ± 3.53	0.15 ± 0.004
Ascorbic acid (Std.)	81.41 ± 0.39	93.85 ± 0.64	96.75 ± 1.35	1.89 ± 0.070

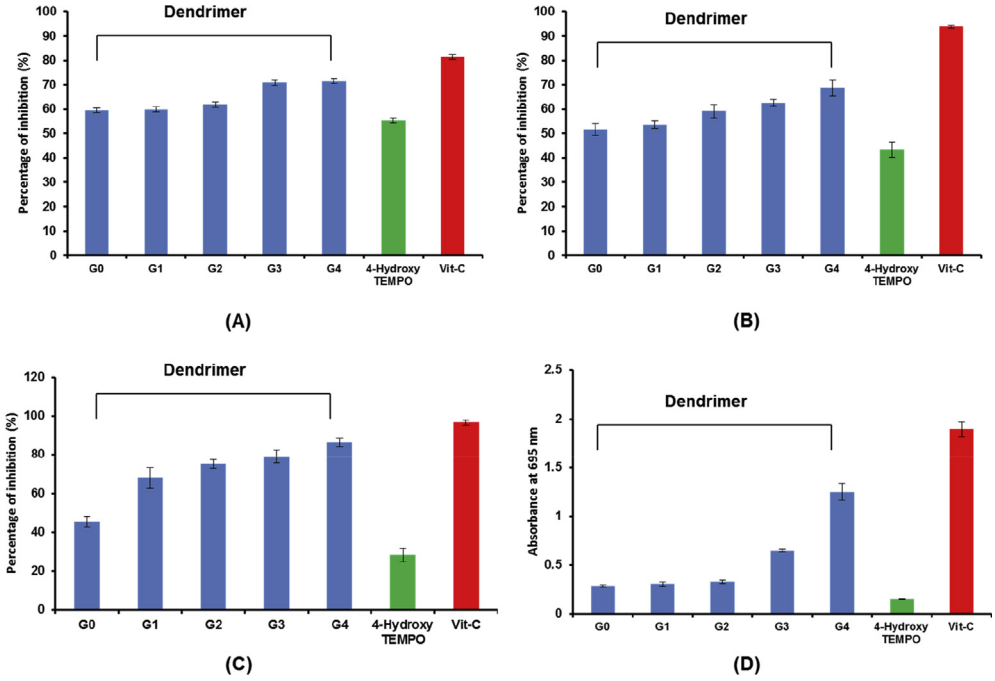

Fig. 1. Antioxidant activity of TEMPO functionalized polyurethane dendrimers with reference to vitamin-C as standard. (A) Nitric oxide radical scavenging; (B) DPPH radical scavenging, (C) hydrogen peroxide scavenging, (D) total antioxidant capacity of dendrimers.

2. Experimental design, materials and methods

2.1. Free radical scavenging activity of TEMPO functionalized polyurethane dendrimers

Free radical scavenging capability of TEMPO functionalized dendrimers against nitric oxide radical (NO), DPPH radical and hydrogen peroxide as well as total antioxidant power of dendrimers were examined using a THF solution containing 200μg/mL of each sample.

2.2. Nitric oxide radical scavenging activity

Nitric oxide radical scavenging activity of TEMPO functionalized dendrimers was determined by Griess Ilosvay reaction using sodium nitroprusside [2]. In a typical experiment, the reaction mixture containing 2 mL of sodium nitroprusside (10 mM) and 0.5 mL of phosphate buffer (pH-7.4) was mixed with 0.5 mL of any one of the TEMPO functionalized dendrimers or vitamin-C or 4-hydroxy TEMPO solution and incubated for 150 min at 25 °C. After the incubation period was over, 0.5 mL of nitrite was pipetted out and 1mL of sulfanilic acid reagent (0.33% of sulfanilic acid in 2% glacial acetic acid) was added to it and kept for 5 min. Then, 1 mL of 1% naphthyl ethylene diamine dihydrochloride (NEDD) was added and allowed to stand for 30 min at 25 °C. The absorbance of pink colour of the solution was read at 540 nm. The percentage of nitric oxide inhibition was calculated using the following equation:

$$\text{Percentage (\%) of nitric oxide radical scavenging assay} = [(A_0\text{-}A_1)/A_0] \times 100.$$

where A_0 was the absorbance of control, and A_1 was the absorbance of the treated sample.

2.3. DPPH radical scavenging activity

The DPPH radical scavenging activity of TEMPO functionalized dendrimers was evaluated according to standard procedure [3]. In a typical experiment, about 2 mL of any one of the TEMPO functionalized dendrimers or vitamin-C or 4-hydroxy TEMPO solution was added to 2 mL of 0.1 mM diphenyl picrylhydrazyl (DPPH) solution in methanol and incubated at 37 °C in the dark room for 30 min. The absorbance was read at 517 nm using methanol as a blank. The percentage of DPPH radical scavenging activity was determined as follows.

Percentage (%) of DPPH radical scavenging assay $= [(A_0\text{-}A_1)/A_0] \times 100$.

where A_0 was the absorbance of control, and A_1 was the absorbance of the treated sample.

2.4. Hydrogen peroxide scavenging activity

Hydrogen peroxide scavenging activity of TEMPO functionalized dendrimers was determined by monitoring the reduction of H_2O_2 [4]. Briefly, in a typical experiment, 0.4 mL of any one of the TEMPO functionalized dendrimers or vitamin-C or 4-hydroxyTEMPO solution was added to 0.6 mL of 40 mM H_2O_2 solution and made up to 2 mL using 50 mM sodium phosphate buffer (pH 7.4) and incubated for 40 min at 30 °C and the absorbance was read at 230 nm. The percentage of inhibition of H_2O_2 was calculated as follows.

Percentage (%) of hydrogen peroxide radical scavenging assay $= [(A_0\text{-}A_1)/A_0] \times 100$.

where A_0 was the absorbance of control, and A_1 was the absorbance of the treated sample.

2.5. Total antioxidant activity

The total antioxidant activity of TEMPO functionalized dendrimers was determined by standard method [5]. 1mL of any one of the TEMPO functionalized dendrimers or vitamin-C or 4-hydroxy TEMPO solution was mixed with 3 mL of reaction mixture containing 0.6 M sulfuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate. The content was incubated for 90 min at 95 °C. After the incubation was completed, the sample was cooled to room temperature and absorbance was measured at 695 nm.

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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 related to this article can be found at https://doi.org/10.1016/j.dib.2019.104972.

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