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 (H₂O₂) radicals. The total antioxidant activity of the dendrimers was also reported and compared with pure 4-hydroxy 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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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 radical (NO), DPPH radical and hydrogen peroxide as well as total antioxidant activity of dendrimers were examined at 200μg/mL concentration of each sample. 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.

### 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.

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

| Dendrimer | Nitric oxide radical (in %) | DPPH radical (in %) | Hydrogen peroxide (in %) | Total antioxidant activity (Absorbance at 700 nm) |
|-----------|-----------------------------|---------------------|---------------------------|-----------------------------------------------|
| 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 | 55.42 ± 0.38                | 43.36 ± 3.08        | 28.31 ± 3.53              | 0.15 ± 0.004                                  |
| TEMPO     | 81.41 ± 0.39                | 93.85 ± 0.64        | 96.75 ± 1.35              | 1.89 ± 0.070                                  |
| Ascorbic acid (Std.) | 81.41 ± 0.39 | 93.85 ± 0.64 | 96.75 ± 1.35 | 1.89 ± 0.070 |
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:

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

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

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.
2.3. 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.

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

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.

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

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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