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On the absorption of cosmic radiation by employment of fullerene-bound 2-(2,6-dihydroxophenyl)benzaldehyde

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Abstract

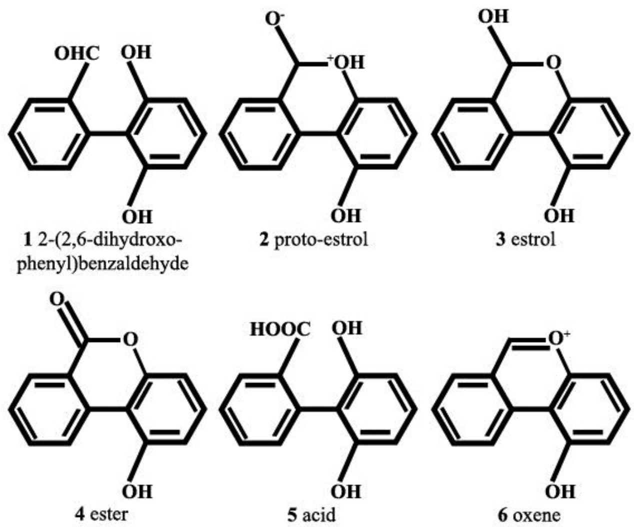
By switching between several conformational and chemical modes, 2-(2,6-dihydroxophenyl)-benzaldehyde can absorb harmful radiation, especially cosmic radiation. Dispersion of fullerenes carrying adsorbed 2-(2,6-dihydroxophenyl)benzaldehyde in the Martian stratosphere and mesosphere should contribute considerably to the atmospheric protection from harmful radiation on Mars.

Background

The terraforming of Mars comprises adjustment of several parameters, as well as several approaches addressing each of those parameters. For Mars to become habitable, the temperature has to be raised, a breathable atmosphere has to be created, oceans need to be established, and the landscape and soil transformed into an environment suitable for plant and animal life [1, 2]. Last but not least, Mars needs protection from harmful radiation [2]. The lack of any substantial magnetic field leaves Mars open to cosmic radiation (in this article including the solar wind and other harmful space-based radiation), and this has of course has been addressed in several manners, such as local magnetic field generators [3], radiation-protective clothing [4], gene-repair techniques [1], the equatorial magnetizer [3] and more. Nevertheless, these measures can never fully satisfy the need for protection.

We here propose the employment of 2-(2,6-dihydroxophenyl)benzaldehyde (**1**) as an atmospheric agent, similar to ozone, in order to increase the much-needed radiation protection of Mars.

This compound is capable of undergoing oxidative and reductive transformations, as well as electromagnetical exitation without decomposing. Subsequent loss of energy by IR emmission will result , not only in radiation protection, but also in increased heating of the atmosphere, a most welcome addition.



Scheme 1. Structure of aldehyde **1** and its derivatives **2** through **6**, which can all be reached by atmospheric reactions involving different kinds of radiation.

Chemical properties of 2-(2,6-dihydroxo-phenyl)benzaldehyde

Scheme 1 shows 2-(2,6-dihydroxophenyl)benzaldehyde **1** and several of its derivatives discussed in this article. The basic structure centers on a biphenyl with its ability to switch between coplanar and perpendicular configuration. This ability is fine-tuned by the hydroxo- and aldehyde substituents, which also dictate the different derivatives available through chemical *in situ* conversions, and by the fullerene carrier.

Aldehyde **1** can absorb energy in several different ways [5]. The conjugated system absorbs UV, and other electromagnetic radiation, the energy being absorbed by transitioning into rotational form, or into proto-estrol **2** and subsequently into estrol **3**. High energy absorption can be achieved by conversion of estrol **3** into the oxene **6**, and the absorption properties of **4**, **5**, and **6** broaden the absorption band so that it covers a wide range of harmful radiation. The energy can also be transferred to the fullerene, or absorbed by the fullerene and transferred to **1** or its derivatives. The energy can then be dissipated by relaxation through several rotational and vibrational modes of both **1** (and its derivatives) and the fullerene.

Similarily, the energy from beta particles (electrons), which are also prevalent in cosmic radiation, can be absorbed and dissipated via rotational and vibrational modes. In this case, rotational modes are the most important, being able to accommodate the anti-bonding orbital occupied by the extra electron [5]. More importantly, beta absorption is relied upon to regenerate compounds **4** and **5** by reduction into **3** and **1**, respectively.

Protons are another major constituent in cosmic radiation. Ester **4** is generated by the absorption of protons by oxene **6** or estrol **3**, while acid **5** comes from the oxidation of aldehyde **1**. Oxidation can also be effected by atmospheric ozone when the oxygen level is raised enough to allow ozone chemistry. Ozone is, of course, another important consideration for radiation protection, but it has a much narrower range of radiation it can absorb.

Airborne fullerene particles

Heavy compound such as **1** are not naturally occurring in the atmosphere. This is mostly because of the spontaneous aggregation of large compounds [6]. Fullerenes present an interesting solution to this problem. Their spherical form encases vacuum, making them light, but they also don't aggregate very well. This property can be enhanced by the binding of molecules of **1** in strategic positions on the fullerene. The modification of fullerenes is straightforward, and useful procedures have been developed [7].

Nevertheless, fullerenes will aggregate if found in higher concentrations, necessitating a dissipative procedure for distribution in the atmosphere. We propose that evaporative dissipators be used to molecularize the agent and spread it in the stratosphere, or, even more desirable, in the mesosphere. At this elevation, the agent should have the long life-time needed for economic feasibility.

In order to get the agent up to the mesosphere, floater technology could be used, as done when harvesting lightning energy between charged clouds. Some minor refinements may be necessary to suit this purpose and get to the higher elevation, but the investment would be well worthwhile.

Conclusion

We propose the full-scale production and employment of this agent (fullerene-bound 2-(2,6-dihydroxophenyl)benzaldehyde) in the Martian atmosphere.

The agent has showed absorption of a considerable part of cosmic and other harmful radiation, including electrons, protons, and high-energy electromagnetic radiation [5]. Widespread employment in the mesosphere should significantly reduce radiative damage to all life-forms, including humans.

References

[1] K. S. Robinson "Red Mars Trilogy", *Bantham Spectra*, 1993 AD.

[2] R. M. Zubrin, C. P. McKay "Technological Requirements for Terraforming Mars", *Pioneer Astronautics & NASA Ames Research Center*, 1993 AD.

[3] J. J. Fryxelius et.al. "Addressing the Martian Magnetosphere", *Journal of Terraforming*, 2363 AD, vol. 293, p. 3064-3076.

[4] J. Jacovitty "Rad-Clothes – the New Fashion?", *Martian Materials*, 2368 AD, vol. 22, p.391-396.

[5] J. J. Fryxelius "Absorption Properties of 2-(2,6-dihydroxophenyl)benzaldehyde", *Tharsis Journal of Chemistry*, 2374 AD, vol. 23, p. 435-439.

[6] M. Elimelech, J. Gregory, X. Jia, R. Williams "Particle Deposition and Aggregation: Measurement, Modelling and Simulation", *Butterworth-Heinemann*, 1998 AD.

[7] A. RamíRez-Monroy, T. M. Swager "Metal Chelates Based on Isoxazoline[60]fullerenes", *Organometallics*, 2011 AD, vol. 30, p. 2464–2467.