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SHORT COMMUNICATION

FULLERENES: EXPERIMENTAL EVIDENCE FOR A NULL RISK OF SKIN IRRITATION AND ALLERGY

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ABSTRACT

The results of the physiological testing are presented which show that, despite its biochemical activity, the fullerene matter does not pose any health hazard related to skin irritation and allergic risks.

Since the discovery of C_{60} in 1985, there has been a flurry of scientific activity on fullerene nanostructures, embodied in over 15 000 papers so far. One of the challenging and exciting research areas is related to the bioactivity of fullerenes and their derivatives[1]. DNA/fullerene hybrid materials[2] and fullerene-modified proteins[3] were assembled. Fullerenes also act as an effective anti-

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oxidant and were often characterized as "radical sponges"[4]. Fullerene derivatives were also found to inhibit AIDS viruses[5] and to kill cancer cells[6]. Carboxyfullerenes were positively tested as neuroprotective agents, too[7]. C_{60} was also reported to efficiently produce singlet oxygen.

With the continually rising scope of research on the biological properties of fullerene nanostructures the assessment of their potential health risk due to a free radical scavenging activity[8] is relevant. Earlier, a clinic study did not reveal any cancerogeneous toxicity of C_{60}[9]. Here we show that regardless of the fullerene content (in the range between 0 and 15 wt%) the soot produced routinely in the process of arc sublimation of graphite does not present any risk regarding skin irritation and allergy potential.

To assess whether fullerene matter can induce any significant skin hazards, two methods were chosen that are routinely applied in dermatological testing of skin sensitivity. Thirty volunteers reporting various irritation and allergy susceptibilities were subjected to a patch test (filter paper Whatman 3 saturated with water suspension of fullerene soot) and controlled during 96 hours. In the second method, the modified Draize rabbit eye test was carried out. Four albino rabbits were tested. One eye of each rabbit was instiled with 0.2 ml of

Table

Operating parameters of fullerene soot synthesis and the results of its testing

Expt no.	Current (A)	Voltage (V)	Plasma gas	Sublimation rate (mg/s)	C_{60} content (wt%)	Patch test	Draize test
1	90	20.5	Ar	7.0	0	*	**
2	65	19.5	He	3.0	0.6	*	**
3	70	20.0	He	3.6	14.8	*	**

* negative result of testing after 96 hrs

** rabbit's eye abnormality not observed after 72 hrs

water suspension of fullerene soot while the other eye was a reference. The rabbits were controlled after 24, 48, and 72 hrs.

Table presents both the operating parameters of syntheses of different fullerene soot in an automated dc arc system[10] and the results of soot activity testing. Experiments 1 and 2 were carried out at low pressure (5 mb) while test 3 was performed at 133 mb which is known to be optimal for the most efficient fullerene synthesis.

Given the consistent results from these two studies, it is unlikely that working with fullerene soot is associated with any risk of skin irritation and allergy. Thus, no special precausions have to be taken while working with fullerene nanostructures. Research is in progress regarding the biological relevance and toxicity of carbon nanotube material which could, theoretically, reproduce the behavior of asbestos by reacting with cellular components to produce damaging byproducts.

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REFERENCES

1. Hirsch, A. et al., J. Am. Chem. Soc., 1994, 116, 9385.
2. Cassel, A. M. et al., Angew. Chem. Int. Ed., 1998, 37, 1528.
3. Kurz, A. et al., Chem. Commun., 1998, 4, 433.
4. McEwen, C. N. et al., J. Am. Chem. Soc., 1992, 114, 4412.
5. Friedman, S. H. et al., J. Med. Chem., 1998, 41, 2424.

6. Li, W. et al., 2nd Int. Coll. Sci. Technol. Full. 7-10 July 1996, Oxford, U.K., p. 118.
7. Dugan, L. L., Proc. Natl. Acad. Sci. USA, 1997, 94, 9434.
8. Chiang, Y. L. et al., Chem. Commun., 1995, 1, 1283.
9. Zakharenko, L.P. et al., Dokl. AN, 1994, 335, 261.
10. Lange, H. et al., Rev. Sci. Instrum., 1997, 68, 3723.

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