

Uranium Estimation in Some Indian Toothpastes

SURINDER SINGH & H S VIRK*

Department of Physics, Guru Nanak Dev University, Amritsar

Received 23 October 1982; revised received 24 January 1983

The fission track technique has been used to estimate uranium concentration in some toothpastes manufactured in India. Uranium content varies from 0.91 to 3.56 ppm in selected varieties of toothpastes.

The solid state nuclear track detector (SSNTD) technique, because of its simplicity and applicability, has attracted many users in diverse fields such as anthropology, archaeology, biology, medical sciences and industrial technology¹. The heaviest naturally occurring trace element, uranium, plays an important role in these investigations. The technique has already been exploited by various workers²⁻⁵ for the trace determination of uranium in semiconductors, water, milk powders, human blood, plants, soils, Indian cigarettes (tobacco), tea leaves, portland cement, detergents and soaps, coal, flyash, steel, etc. In our laboratory, we have applied this technique for the trace determination of uranium in some toothpastes manufactured by various agencies in India. The aim of this particular work is to estimate the level of uranium content in toothpastes for the studies of radiation health hazards.

We followed the external detector method as suggested by Fleischer *et al.*¹ and Fisher⁶ for bulk determination of uranium in homogeneous solids. The procedure is well-established. Toothpastes were dried in an oven at 200°C for 24 hr. The dried powder (50 mg) was homogeneously mixed with 100 mg of methyl cellulose used as a binding material. The mixture was pressed into a pellet by a specially designed hand-pressing machine. These pellets were then covered on both sides with lexan plastic discs of the same diameter as the pellet. One such pellet was made of the standard glass dosimeter. The pellets covered with lexan discs were enclosed in an aluminium capsule and were irradiated with a thermal neutron dose of 5×10^{15} (nvt) from the CIRUS Reactor of Bhabha Atomic Research Centre, Trombay. After irradiation, the lexan discs were etched in 6N NaOH at 70°C for 30 min and were scanned for fission track density. A blank lexan detector was irradiated along with the samples and checked for background tracks. It was found almost devoid of background tracks.

Table 1—Uranium Estimation in Some Indian Toothpastes

[U Content of glass dosimeter = 20 ppm; thermal neutron dose = 5×10^{15} (nvt)]

Trade name of the toothpaste	Manufacturing agency	U-content (ppm)
Signal	Hindustan Lever Ltd, Bombay	0.91
Closeup	Hindustan Lever Ltd, Bombay	1.04
Promise	Balsara Hygiene Products, Bombay	1.48
Cosmo	Hindustan, Rimmer, Delhi	1.78
Colgate	Colgate Palmolive Ltd, Bombay	1.82
Flash	Flash Laboratories (Pvt) Ltd, Bombay	2.41
Forhans	Geoffrey Manners & Co Ltd, Bombay	2.71
Binaca	Ciba-Geigy of India Ltd, Bombay	2.76
Neem	Calchemico, The Calcutta Chemical Co Ltd, Calcutta	2.76
Vicco vajradanti	Vicco Laboratories, Bombay	3.56

The uranium concentration was calculated using a simple relation for external detector method¹:

$$U_x = U_s \left(\frac{T_x}{T_s} \right) \left(\frac{I_s}{I_x} \right) \left(\frac{R_s}{R_x} \right) \quad \dots (1)$$

where the subscripts x and s stand for unknown and standard respectively, U , the uranium concentration, T the fission track density, I the isotopic abundance ratio of ^{235}U and ^{238}U and R the range of fission fragments in mg/cm^2 . The correction factor (R_s/R_x) approaches unity for most of the silicate materials and plastics¹.

Toothpastes consist of various agents such as polishing agents or abrasive materials, humectants, binders, sweetening agents, flavouring agents, surfactants, flourides which act as a germicide and water. Materials used under these subheadings may vary from one manufacturer to another depending upon their formulation. Minerals, inorganic and organic matters present in the toothpastes are generally contaminated with minor amounts of uranium.

The uranium content of various toothpastes calculated by using Eq. (1) is given in Table 1. The uranium content has been found to vary from 0.91 to 3.56 ppm. Signal toothpaste manufactured by Hindustan Lever Ltd., Bombay, has a minimum uranium content of 0.91 ppm, whereas Viccovajradanti manufactured by Vicco Laboratories, Bombay, has yielded a maximum content of 3.56 ppm. Higher value of uranium in Viccovajradanti paste may

be due to the presence of minerals derived from the plant sources. The uranium content in the toothpastes is quite low and is not harmful for society.

References

- 1 Fleischer R L, Price P B & Walker R M, *Nuclear tracks in solids, principles and applications* (University of California Press, Berkeley, USA), 1975.
- 2 Abdullaev Kh, Zakhavataev B B & Perelygin V P, *Radiobiology (USA)*, **8** (1969) 765.
- 3 Carpenter B S & Cheek C H, *Anal Chem (USA)*, **44** (1970) 600.
- 4 Chakarvarti S K, Lal N & Nagpaul K K, *Proc 10th Int Conf on Solid State Nuclear Track Detectors*, held in Lyons, 2-6 July 1979, 701.
- 5 Suri P S, Singh S & Virk H S, *Indian J Pure & Appl Phys*, **19** (1981) 1131.
- 6 Fisher D E, *Anal Chem (USA)*, **42** (1970) 414.