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Measurement of radon concentration in blood and urine samples collected from female cancer patients using RAD7

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ABSTRACT

The environmental monitoring of radon in the female blood and urine with the cancer problems has been carried out by using RAD7. This study has been undertaken for the purpose of health risk assessments. The significant of the results is this study indicate to the health risk assessments by showing association between radon concentration of blood and urine and cancers. The concentration of radon in blood samples varies from 417 to 714 Bq m^{-3} with an average of 570.25 Bq m^{-3} before irradiation and varies from 463 to 881 Bq m^{-3} with an average of 734.50 after irradiation. The concentration of radon in urine samples varies from 149 to 289 Bq m^{-3} with an average of 208.50 Bq m^{-3} before irradiation and varies from 239 to 1990 Bq m^{-3} with an average of 1062.62 Bq m^{-3} after irradiation. This study shows association between radon and cancers, also the results showed that the Rad7 particularly, has ability to measuring the concentration of blood and urine samples with higher levels of radon and correlation together.

1. Introduction

Radon is a naturally occurring odourless, colourless, tasteless inert gas which is imperceptible to our sense. It is produced continuously from the decay of naturally occurring radionuclide such as U-238, U-235, and Th-232. The isotope Rn-222, produced from the decay of U-238, is the main source (approximately 55%) of internal radiation exposure to human life. Radon gas escapes easily from the ground into the air and disintegrates through short-lived decay products called radon daughter or radon progeny. When radon gas itself is inhaled, most is exhaled before it decays, a small part of the inhaled radon and its progeny may be transferred from the lungs to the blood and transported throughout the body, where they can deliver a dose to other organs (Ali, 2013; Duggal, Rani, & Mehra, 2012). Kidney related diseases have also been observed in some people exposed to radon. The reason is that kidney receives the highest dose compared to other body organs after radon is transferred from the lung to the kidney by blood (Ahmad et al., 2014; Henshaw, Eatough, & Richardson, 1990). Radiation plays a significant role in life generally, and

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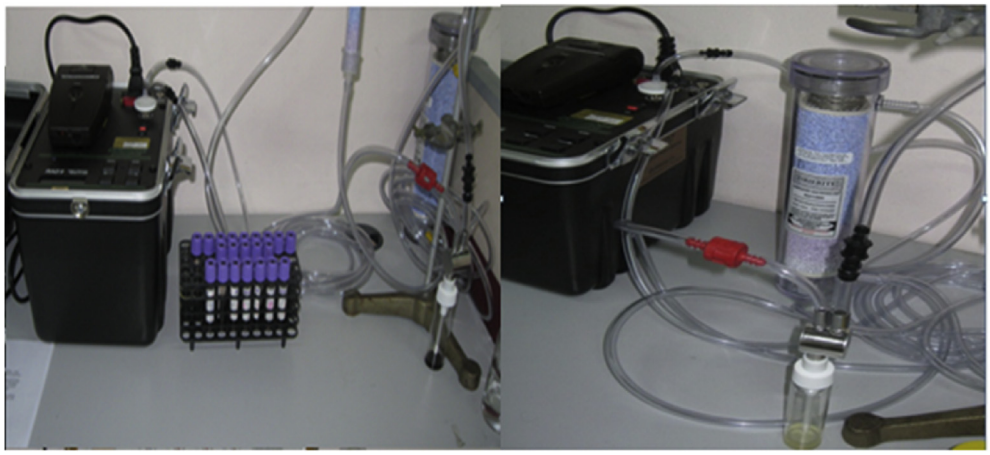

Fig. 1 – Measurement of radon concentration in blood and urine samples using RAD7.

Table 1 – Radon concentration (Bq m^{-3}) and relative humidity values in female blood samples before and after irradiation with Ra-226 sources using RAD7 at different temperature.

Test no.	Control							
	Before irradiation				After irradiation			
	Temp. °C	RH %	Activity Bq m^{-3}	Uncertainty	Temp. °C	RH %	Activity Bq m^{-3}	Uncertainty
1	26.4	6	648	451	28.3	4	835	497
2	27.7	5	417	386	25.8	5	602	439
3	27.1	4	603	440	26.8	4	834	497
4	27.1	4	417	386	26.4	5	463	400
5	25.2	5	714	474	28.9	4	881	508
6	25.5	4	649	463	28.3	4	881	508
7	25.5	4	556	427	28.3	5	685	300
8	26.8	4	558	426	27.4	4	695	463
Av.	26.41	4.5	570.25	431.62	27.52	4.37	734.50	451.50

in the fields of life sciences and medicine. Radiation can result in several different types of biological effect depending mainly on the part of the body irradiated (ICRP, 2003). The first case of radiation induced leukemia was reported in 1911. In particular with respect to the relative biological effectiveness of alpha-particles and the doses to the cells relevant to leukemia induction, which are probably much lower than that required for radon to be causative (Wolfft and Stern, 1991).

Thereafter, there has been keen interest in the study of risks associated with radiation. Disparity in effects of radiation on human health is based on individual genetic makeup and susceptibility, which is discernible only in cases that correlates with exposure to radioactivity. This has been demonstrated by studies on the survivors of atomic bomb explosions in Japan (Abu–Saleh et al., 2005). Radioactive radon gas is generally regarded as a health hazard, naturally because of its ability to produce several different types of biological effects (ICRP, 1969). High concentration of radon and its decay product is widely known to be dangerous to human health. It is possibly associated with different types of cancer and especially with lung cancer. It has very serious effects on human health due to large scale abundance of its parents and its longer half life. Radon has been considered as second leading cause of lung cancer after smoking (ICRP, 2004). A 2.4 mSv average annual dose has been estimated from natural radiation sources to the world population (Ahmad et al., 2014). One important advantage of solid state devices is the ability to electronically determine the energy of alpha particle (Duggal et al., 2012).

Table 2 – Variation of radon concentration (Bq m^{-3}) with age in female blood samples.

No. of samples	Age/Year	Δ Activity Bq m^{-3}
1	35	187
2	33	185
3	45	231
4	21	46
5	28	167
6	47	232
7	30	129
8	31	137

2. Methodology

Blood and urine samples were collected from 8 female cancer patients having age between 18 and 40 years. It should be noted that all female have problems with cancer (different types of cancer and they not exposed to radiotherapy). The samples were collected at clinic (Health Center) of Universiti Sains Malaysia (USM), Palau Penang, Malaysia. Each sample