

H E A L T H

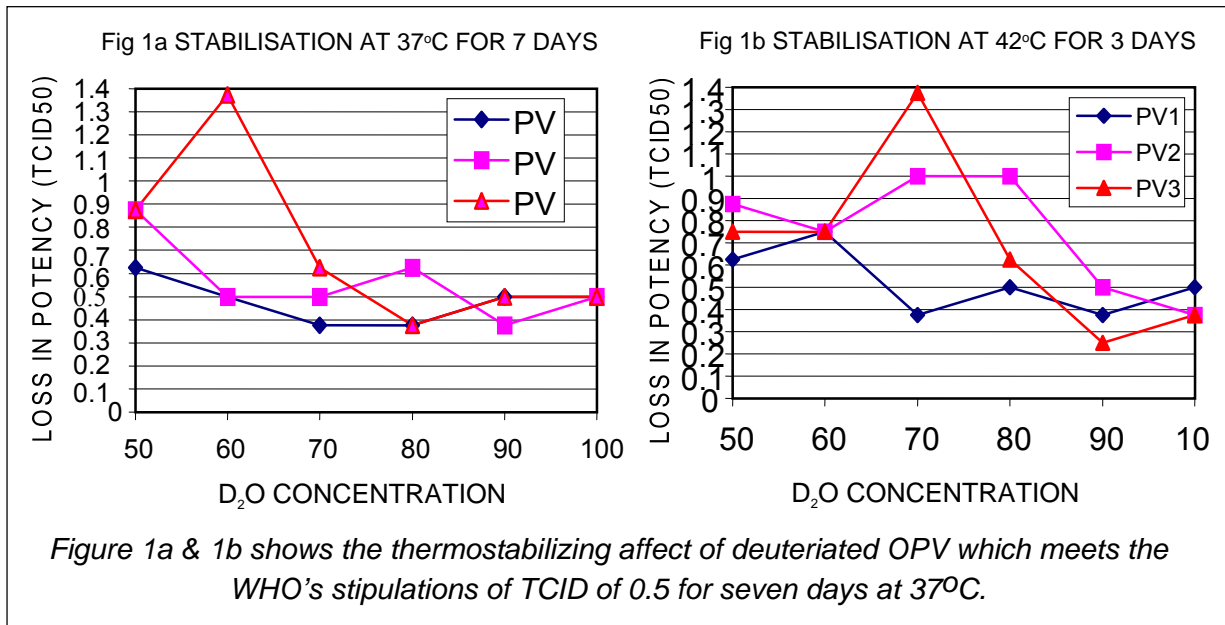
Technologies for Better Quality of Life

USE OF HEAVY WATER IN THE FIELD OF HEALTH CARE AND CLINICAL SCIENCES

THERMOSTABILIZATION OF ORAL POLIO VACCINE

Heavy water is used as a moderator and coolant in the pressurised heavy water reactors and there is often a misconception that since it is used in nuclear reactors, it is radioactive. Infact, deuterium is a stable isotope of hydrogen which goes in making heavy water is as stable an isotope as normal hydrogen is, and no radioactivity is associated with it.

R&D which began in forties and fifties on the use of heavy water in fields other than its use as moderator in nuclear reactors, was accelerated in late nineties when availability of heavy water globally became a wee bit better (India is one of globally leading nations today in the manufacture of heavy water) gave complete new thrust. It is shown to be a very precious and special product especially in the field of biological, medical and chemical field. Being totally non-radioactive – and some important quantum properties which deuterium atom exhibits, it has tremendous potential to be used in several fields which could have a long term benefits in the field of health care. Some of the potential fields where heavy water could be used are illustrated below:



Heavy water has a unique property of thermo stabilisation of several biological molecules, cells, tissues etc. Experiments carried out for thermo-stabilisation of Oral Polio Vaccine (OPV) has clearly indicated that heavy water suspended vaccine can withstand 37°C for seven days without loss of any potency. This would be of enormous importance to a tropical country like India, where break in the cold chain can create loss of potency of OPV. Therefore supplementing the OPV by using heavy water during its manufacture can bring about dramatic improvement in retention of the vaccine potency even if there is a loss in the cold chain when it reaches the remote areas of this country. Lab scale and field scale trails verifying such a beneficial property of heavy water is completed and is awaiting DCI clearance and clinical trial. Besides OPV, even the vaccines used in poultry, cattle and domestic animals can also be prepared in heavy water for enhanced thermo-stabilisation property which again will have enormous application in India.

In another application of heavy water, several drugs (already in regular clinical practice, on deuteration) have been shown to undergo favourable alterations in respect of their pharmacokinetics leading to enhancement of clinical efficacy or moderation of adverse effect. Use of heavy water in such clinical medicine will be pertinent to the knowledge of disease pattern and drug prescription profile.

There is a growing evidence from drivers approaches demonstrating the potential of heavy water as a adjunct chemotherapy, photo dynamic therapy and radiation therapy of cancer. This is an area which has been persuaded vigorously in several laboratories world wide and to be used in the context of types and nature of malignancy prevalent in the Indian population.

Heavy water in small doses can also be used for bringing down blood pressure due to its anti-hypertension properties. It is reported to be anti-mutagenic and radio- protective. This opens up new avenues in this vital field.

Several algae and fungi can grow well in heavy water and thereby leading to the biogenesis of important molecules fully deuteriated, which could be precursors of high value product with applications in bio technologies. Heavy water has also shown to be a good moderating molecule on human body with properties which retard the process of ageing and can be used at low doses for therapeutics purposes. Heavy water is also used as a tracer for large number of studies in human, in the areas of clinical nutrition, physiology and medicine.

Low doses of Heavy Water have not only shown to be safe among infants, adults and pregnant women, it is shown to have tremendous beneficial properties.

Thus, heavy water finds applications in vast number of medical and health care fields and this can be exploited for the societal benefits. India's leading position in this complex technology is an added advantage.

Use of heavy water in the study of energy metabolism for the soldiers working in high altitude battlefields.

Heavy water and $H_2^{18}O$ is used as double labeled water for the determination of total energy expenditure and to calculate the energy intake and its distribution. This is particularly useful to the high altitude climbers or the battalion located in such places such as Siachin Glacier. The Defence Institute of Physiological Studies and Allied Sciences under the Defense Research & Development Organisation has sought Heavy Water Board's assistance in the supply of such double labeled water. Besides this, $H_2^{18}O$ is also used in medical cyclotron application. The board is proposing to take up synthesis of such compounds as extension of its current activities.

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