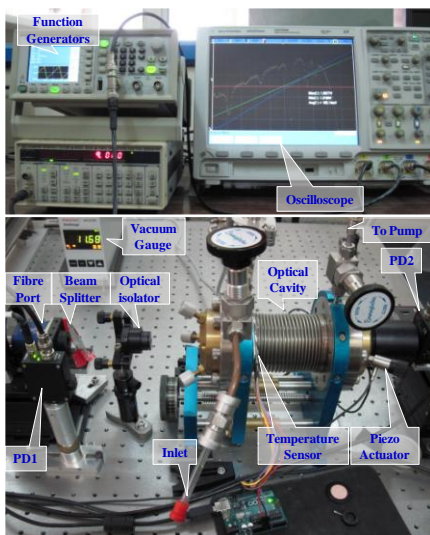


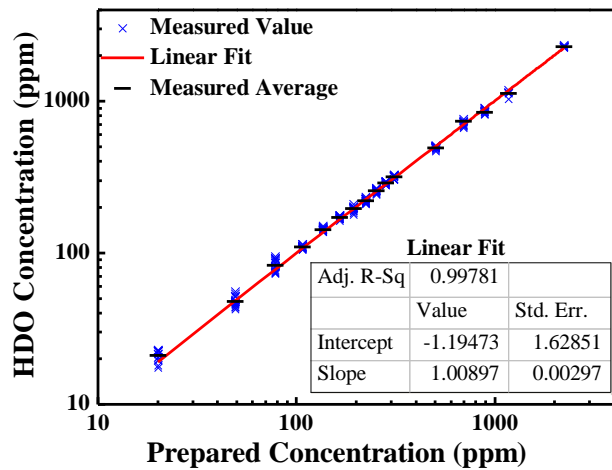
## Trace HDO (semi heavy water) detection system

An indigenous near-infrared laser absorption spectroscopy based Heavy water trace analysis system has been developed in the laboratory (Fig. 1). Since trace amount of heavy water readily reacts with water in surroundings, heavy water leak monitoring is based on measurement of HDO concentration in air and water samples. The HDO absorption line at  $7191.039\text{ cm}^{-1}$  is used in the monitoring system. The setup is based on off-Axis integrated output spectroscopy, for achieving high sensitivity.

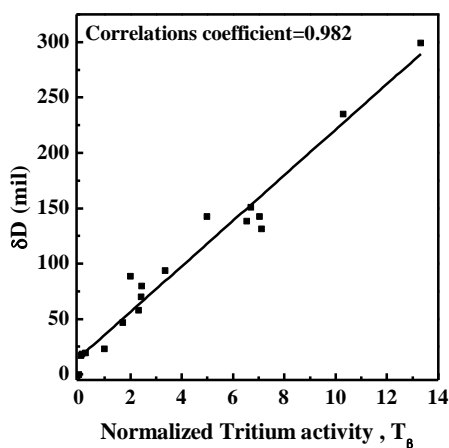
A linear calibration curve has been obtained of HDO concentration ranging from 20 -2200 ppm, (Fig. 2). HDO detection sensitivity in water samples is  $\pm 1.5$  ppm using cavity length dithering and 160 sec averages. The measured HDO concentration shows a very good correlation with the well-established techniques such as (i) tritium activity measurements using liquid scintillation counter (Fig. 3a) as well as (ii) Isotope Ratio Mass Spectrometer (Fig. 3b). The detection sensitivity of HDO fraction in air is 45 ppb, which is sufficient for the detection of minor leakages in PHWRs.



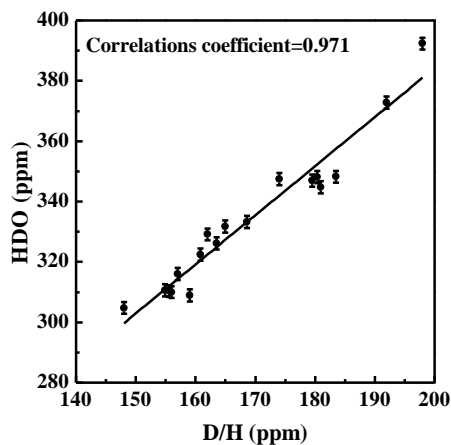
**Figure 1** Photograph of the developed setup.



**Figure 2** Calibration of HDO concentration. Plot shows linearity in measurement for HDO concentration ranging from 20 ppm to 2280 ppm.



(a)



(b)

**Figure 3** Plot showing the correlation between measured HDO concentration and results with measurements of (a) Tritium activity and (b) D/H ratio.