

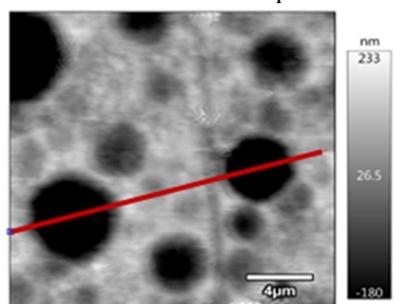
# Alpha Radioactivity Measurements from Thermal Power Plant Effluents Employing CR-39 Polymeric Solid State Nuclear Track Detector

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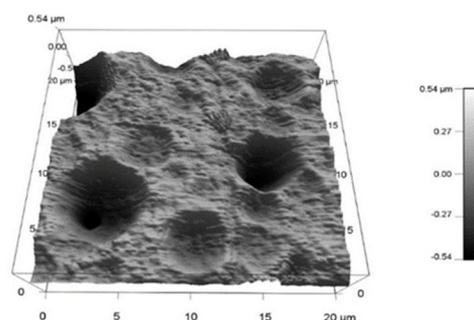
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Natural radioactivity is release in the environment during the combustion process of coal at various thermal power plants. Coal contains higher contents of  $\alpha$ -emitting radionuclides such as U-238, Th-232 along with their decay elements, which cause a potential health risk to the population. The Solid State Nuclear Track Detection (SSNTD) is one of the most convenient advanced analytical techniques used to measure low level alpha radioactivity due to its numerous advantages such as simplicity, high sensitivity and capacity to store permanent records. In the present studies, the effluent waste samples were collected from the coal fired Thermal Power Plant. CR-39 polymeric detector pieces were then exposed for the varying time with residue and filtrate samples for registering the alpha tracks for the  $\alpha$ -detection and measurement. Thus, registered alpha particles in CR-39 detectors were revealed by employing the conventionally used 6M NaOH/KOH etchant and 5% Tetraethyl ammonium bromide (TEAB) as the phase transfer catalyst in 6M NaOH/KOH etchant. Under both compositions of the etchants, the CR-39 detectors were etched at 60°C for 6 h for developing alpha tracks for observations under optical microscope, Spinning disc confocal microscope and Atomic force microscope for better resolutions. The alpha track densities ( $T_d$ ) and alpha track diameters in the etched CR-39 detectors for all samples were measured. The introduction of new chemical etchant effectively improved the uniformity in distribution of alpha tracks, enhanced the track density, and reduced the time of track revelation in CR-39 detectors. Therefore, it could be concluded that the phase transfer catalyst TEAB was highly effective in the etchant for the alpha track revelation and detection as compared to conventionally used 6M NaOH etching method. Apart from measuring alpha tracks and activities, the amounts of the U-238 & Th-232 in the samples were also measured by ICP-MS for understanding the alpha activities measured in the collected effluent samples. The motivation behind this work was to understand the various aspects of alpha track registration from solution medium so that a uniform and consistent set of conditions could be identified and recommended for the analytical applications of this technique.



**Fig 1 (a)** A 2-D image of tracks on CR-39 from thermal power plant effluent filtrate at 20 H exposure time on 6 H etching time obtained by the Atomic force microscope.



**Fig 1 (b)** The 3-D view of tracks on CR-39 from thermal power plant effluent filtrate at 20 H exposure time on 6 H etching time obtained by the Atomic force microscope.

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