A.10: Use of rain water as coolant for components of Indus accelerators

Deionised (DI) water is an essential requirement for many installations like power plants, semiconductor industries, pharmaceuticals, and research organisations like particle accelerator programme etc. where corrosion, scale, and product contamination are the key issues that are to be addressed carefully. Though the purpose of using DI water may differ from application to application, the use of the same in Indus Accelerator Complex, RRCAT addresses the issues of leakage currant, short-circuit between the components, corrosion of vulnerable materials, and scale formation due to change of water temperature.

Though different methods are available to produce DI water used for above mentioned purposes, an appropriate technique is required to be chosen depending upon the quality of the feed water available. Highly saline and high TDS (Total Dissolved Solid) water are generally treated by RO-based treatment scheme, whereas TDS of less than 300 ppm water can economically be treated by conventional ion exchange method using strong cation exchange column followed by strong anion exchange column with mixed-bed unit to generate deionised water having conductivity in the range 0.2 - 0.3 µS / cm and pH in the rang 6.5 - 7.0 if measured online.

Coolant Systems lab (CSL), RRCAT treats water to remove different impurities step by step before the treated water is stored and pumped to accelerator sub-systems for cooling the components. Water quality available in this centre permits the use of conventional water treatment technique comprising of multi-grade filter (MGF), activated carbon filter (ACF), cation exchanger, decarbonator, anion exchanger, and mixed-bed deioniser to produce the required deionised water for accelerator.

CSL has worked hard to exploit the possibility of using rain water as accelerator coolant and has studied thoroughly the quality parameters along with treatment scheme. Rain water has been analysed in the CSL laboratory and few analytical parameters are given in Table A.10.1. Only ionic contaminants have been found to have played a major role in the total impurities present in rain water. The water quality is as good as treated water obtained at the outlet of two-bed deioniser plant. In the treatment scheme, only mixed-bed (MB) deioniser unit has been used, bypassing all the other treatment units which are otherwise required for normal tap water.

Table A.10.1 Quality of rain water available at RRCAT

S No	Parameter	Value
1	Conductivity, µS / cm	16.5
2	pH	6.5 ± 0.2
3	TDS, ppm	12
4	Hardness, ppm as $CaCO_3$	02
5	M. Alkalinity ppm as $CaCO_3$	7.2
6	Sodium, ppm	<1.0
7	KMnO4 demand	BDL

A part of Indus 2 terrace has been used to collect the rain water. The collected rain water is transported to the cemented storage underground tank lined with FRP (Fibre reinforced Plastic). For the transportation of water, FRP pipe line has been used. The transportation line is planned in sections to have bleed-off and sampling facilities along with proper slope for easy transport. The storage capacity is about 110 m3 which is quite enough for year round use in accelerator and providing DI water to other users of this centre.

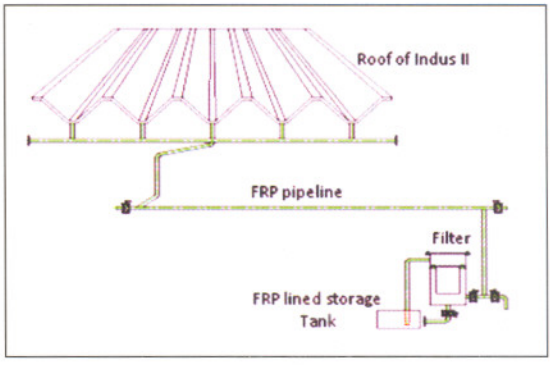

Fig.A.10.1 Layout of rain water harvesting set-up

The merits of this move are very significant. As only mixed-bed unit is used to produce required DI water, a lot of water used to regenerate and rinse the treatment units is saved, giving a big relief for a water scarcity area like ours. In addition to this, hazardous and expensive regenerant chemicals are saved, providing a pollution free environment for all of us. The present system of producing DI water from rain water does not need manpower at site and the task is accomplished in minimum time.

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