Technical Specifications for Isothermal Titration Calorimetric system for characterization of molecular interactions and stability (ITC)
RFX NO. 6100000709 (Reference No. 1000018368)

Applications: Measurement of heat released or absorbed during a binding interaction, characterization of molecular interactions, determination of thermodynamic parameters of interactions between ligand and receptor, assessment of the effect of molecular structure changes on binding, Enzyme kinetics, and protein stability at various temperatures.

The fully automated system must be equipped with control unit, wash module, degassing station, filling & cleaning assemblies, injection syringes, other start-up accessories necessary software's for instrument control, operation analysis of data, viewing and printing enabling accurate determination of thermodynamic parameters such as binding constants, reaction stoichiometry, enthalpy, entropy and protein stability module etc.

System discerption

1. Fully-automated Microcalorimeter
2. Measuring principle: Should be Direct or power compensation measurement of heat released or absorbed during a binding event with the heat compensation, detection via power feedback.
3. Microcalorimetery Cell with syringe tower and Control Unit for real-time operation and post-run data analysis.
4. Washing Module with detergent capability for cleaning cell and titration syringe.
   Software pack includes: ITC thermodynamic data analysis software and Microsoft Windows
5. Accessory kit contains; User manuals, additional syringe, O-rings, temperature standards, fuses, plunger tips, tools,

Detail description :

1. **Cell configuration:** It should be coin-shaped or cylindrical, Peltier elements to provide faster equilibration, faster response time, and better sensitivity.
2. **Cell type:** Should be Non-capillary, enclosed in an adiabatic chamber, must be fixed in place, with active volume of the cell should be 0.2 ml or lower including dead volume. Vendors to specify the working volume and the dead volume for the offered cell.
3. **Cell Material:**
   3.1). Should have a high-sensitivity and inert with easy cleaning and facilities efficient stirring of the solution. It must not react with non-metal and metal ions such as carboxylates, phosphate ions, silver, gold, and magnesium and also should not react with thiol compounds.

3.2) Cell material should also be highly resistance to extreme pH conditions

Vendors to specify the working detail about the resistivity of the constituent material to various possible samples. Cell material should be very high chemical resistance to extremes of pH and solvents, acid, base, and detergent based cleaning materials.

4. **Samples:** In solution state including turbid samples the detectable heat range should be in between ~ 10 ncal to ~ 10.0 µcal or similar. Vendors can specify any deviations.

5. **Injection syringe capacity:** The volume capacity should be in between ≤ 40 µL or ≤ 250 µL depending upon vendors instrumetation and injection syringe volumes

6. **Minimum detectable heat**: ~ 50 ncal to ~10.0 µcal or similar

7. **Injection syringe and wash module:** Purging options to remove air bubbles, automated washing and cleaning of cell and syringe. The injection volume should have high precision

8. **Injection Volume Precision:** 0.01 µL or similar

9. **Equilibration time:** Instrument should have quick re-equilibration between injections. The system should have shorter equilibration time between injections, leading to increased productivity. Movement of instrument operating temperature should be fast with short system equilibration time when moving the temperature. < 5 min (lesser will be preferred) between 35°C to 5°C.

10. **User selectable Feedback Mode:** Multiple feedback mode option

11. **Sample concentration range:** 10 µM or lower

12. **Sensitivity:** Base line noise level measured (RMS average) must be 0.15 nano calories/s or better for coined shaped cell and for Cylindrical shaped Cell, the Baseline stability is 0.02 µWatt/hr and Low noise level is 0.002 µWatt/hr or in the similar range.

13. **Response time:** The system should have response time ~ 15 seconds or lower.

14. **Mixing or stirring speed:** Should have user definable mixing speed with twisted stirring paddle for increasing the mixing efficiency at slow speeds. The system should have multiple mixing speed ~1000 rpm or more for coined shape and for cylindrical shaped cell 0 to 200 rpm.

15. **Operating temperature range:** ~5°C to 80°C with temperature stability ~ ±0.0001°C at 25°C.

16. **Temperature control system:** Peltier controlled system for rapid temperature equilibration.

17. **Binding constants detectable range:** Should be able to detect interactions with binding constants in the range of millimolar to nano-molar for normal binding and millimolar to nano-molar for competitive binding.

18. **Pipette assembly:** Automated and controlled by the software to minimize sample loss or introduction of air bubbles encountered during manual filling.

19. **Temperature control system:** Solid-state thermoelectric devices with active heating and cooling to maintain accurate, precise temperature control.

20. **Instrument Cleaning**: Instrument should have separate solvent access ports available on the instrument for easy cleaning. Cleaning of the stirring and injection systems should be user programmable and fully automated. No manual repositioning of the injection and stirring systems and should be Compatible with non-aqueous solvents.

21. **Software:** Should be compatible with the latest model and upgradable periodically.
    Software:
    (21.1) Should be capable of running instrument, injector control, providing user- selectable binding models, and data merging like: single site, two site, sequential site, competitive site, and enzyme kinetics. Non-linear least square analysis of the data should include calculations to correct for the excluded concentrations of the macromolecules and ligands during each injection. It should be easy to export and use data in other formats. Should allow corrections for heats of dilution and blank effects, Should have experiment optimization tool for post-titration adjustments of all experimental parameters for optimizing subsequent titrations. Should have Dedicated fitting model for Enthalpy Screening data. It should generate high resolution images, which are ready to publish data like, Scatter plot, Statistical plot, Signature plot.

    (21.2) Analysis software: should provide copies of offline analysis software and should not require a separate software supporting license.

22. **Computer**: All in one Computer and necessary software for operation, data collection and analysis, viewing should be provided. Current generation computer will be supply along with the instrument with Windows OS. Monitor High resolution with capability for extension

23. **Data processing**
    Automated and manual; remote connection capabilities
    Including comprehensive data analysis package with scripts. Additional licence for data analysis software

24. **Analysis software:** should provide unlimited copies of offline analysis software and should not require a separate software supporting license.

25. **Training:**
25.1 Must include an intense training by a company expert for all mode of data recording and analysis after installation

25.2 Periodic training by local engineers for usage of the instrument

25.3 There should be at least one service engineer and one application scientist based in India for easy servicing of the instrument.

26.UPS: 10 KVA or appropriate for the instrument

27.Warranty: 5 Years of Comprehensive (all parts, all electronic boards should be covered)

28. A user-list should be provided highlighting installation of similar equipment in other research institutes in India in the recent past. Preferably in any IIT's.