

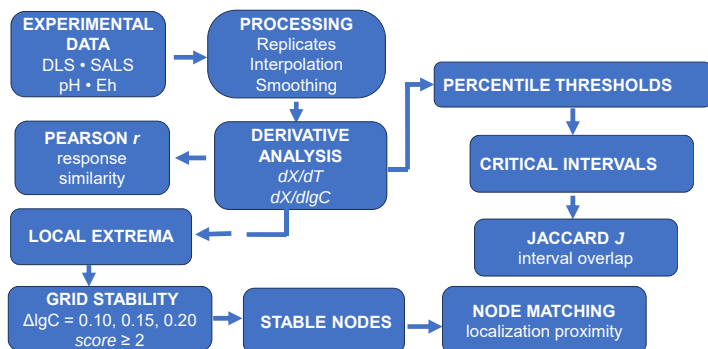
STRUCTURAL REARRANGEMENTS AND INTERSYSTEM RECURRENCE OF CONCENTRATION NODES IN AQUEOUS SYSTEMS: A FORMALIZED MULTIPARAMETER APPROACH

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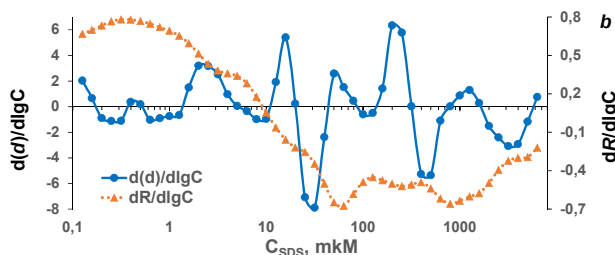
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BACKGROUND

Aqueous systems exhibit nonlinear changes in structural and physicochemical parameters with temperature and concentration. Such changes may be weak, distributed, or overlapping, making characteristic rearrangement regions difficult to identify from individual dependences. Their recurrence across chemically different systems may indicate common concentration-dependent features of aqueous-system organization.



CONCENTRATION-INDUCED REARRANGEMENTS



SDS: 13 stable SALS nodes were identified for d , including 12 reproduced on all three computational grids.

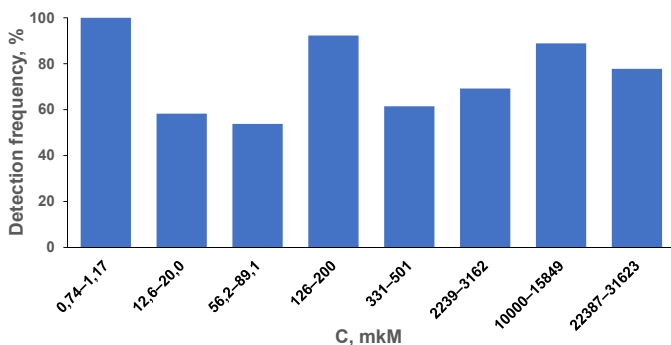
Scale–structure correspondence: 5 of 6 stable $dR/dlgC$ nodes had a SALS node within $|\Delta lgC| \leq 0.15$; mean $|\Delta lgC| \approx 0.07$.

All five matched pairs showed opposite extremum types.

INTERSYSTEM RECURRENCE OF CONCENTRATION NODES

Stable SALS nodes identified from $\backslash(d(d)/d lg C)$ and $\backslash(dN/d lg C)$ were compared across chemically different aqueous systems. Nodes with close logarithmic coordinates were grouped into characteristic concentration regions.

Detection frequency was calculated only for systems in which a given concentration region was experimentally accessible; each system was counted once.



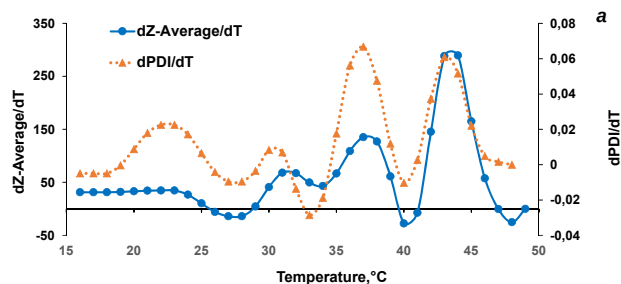
CONCLUSIONS

- The formalized multiparameter approach distinguishes complementary aspects of structural–regime rearrangements: derivative similarity (Pearson r), overlap of critical intervals (Jaccard J), and proximity of stable nodes.
- Temperature- and concentration-dependent analyses revealed reproducible regions of structural change, while chemically different aqueous systems showed pronounced intersystem recurrence in the positions of concentration nodes.
- The scale ratio $R = \lambda_D/l$ provides an additional physicochemical basis for interpreting experimentally identified rearrangements; recurrent nodes should be regarded as characteristic concentration regions rather than strictly fixed universal critical concentrations.

AIM

To develop and test a formalized multiparameter approach for identifying structural rearrangements in aqueous systems and to evaluate the intersystem recurrence of characteristic concentration nodes.

TEMPERATURE-INDUCED REARRANGEMENTS



Characteristic temperatures: 23, 31, 37 and 43–44 °C.

Derivative agreement: $r = 0.753$; $J = 0.750$ (threshold = 0.8).

Closely located extrema of the DLS derivatives identify common regions of intensive temperature-induced structural change.

The scale-based approach compares characteristic spatial scales in the system. The Debye screening length λ_D , determined by the effective ionic strength, characterizes the electrostatic screening scale, whereas $l = n^{-1/3}$ represents the characteristic mean spatial separation of the selected calculation units.

$$R = \lambda_D/l$$

$$R=1: \lambda_D = l \quad R>1: \lambda_D > l \quad R<1: \lambda_D < l$$

For aqueous SDS, R increased from 0.85 at 0.1 μM to a maximum of approximately **2.01 at 12 μM** and then decreased. Thus, in the **10–16 μM** region, λ_D was approximately twice the adopted characteristic spatial scale.

R was used as an **additional physical tool** for interpreting experimentally identified rearrangements, rather than as an independent criterion for defining concentration nodes.