Colloids and Surfaces A: Physicochem. Eng. Aspects 417 (2013) 183–190

Contents lists available at SciVerse ScienceDirect

Colloids and Surfaces A: Physicochemical and Engineering Aspects

journal homepage: www.elsevier.com/locate/colsurfa

Surface tension, surface excess concentration, enthalpy and entropy of surface formation of aqueous salt solutions

Anwar-ul-Haq Ali Shah[a,*], Khurshid Ali[a], Salma Bilal[b]

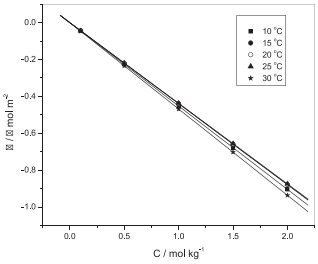
[a] Institute of Chemical Sciences, University of Peshawar, 25120-Peshawar, Pakistan
[b] National Centre of Excellence in Physical Chemistry, University of Peshawar, 25120-Peshawar, Pakistan

HIGHLIGHTS

- Determination of surface tension and density for 10 different salt solutions.
- Estimation of surface excess concentration, enthalpy, entropy of surface formation.
- Decrease in enthalpy of surface formation with concentration.
- Decrease in entropy of surface formation due to double layer formation.

GRAPHICAL ABSTRACT

Concentration dependence of surface excess concentration of KBr solutions at different temperatures.



ARTICLE INFO

Article history:
Received 13 August 2012
Received in revised form 10 October 2012
Accepted 12 October 2012

Keywords:
Surface tension
Salts
Surface parameters
Surface excess concentration
Thermodynamics

ABSTRACT

Surface tensions of aqueous solutions of sodium salts of chloride, bromide and nitrate; potassium salts of chloride, bromide and nitrate; lithium chloride and potassium iodide has been determined experimentally at different concentrations and temperatures ranging from 0.10 to 2.00 mol kg^{-1} and 10–30 °C, respectively. Concentration and temperature dependence of the surface tension of the selected salts has been studied for further estimation of surface excess concentration, enthalpy and entropy of surface formation. The results show that the surface excess concentration decreases linearly with concentration but remains almost constant with the variations of temperature. Similarly the enthalpy of surface formation was observed to decrease with concentration but remained almost constant with the change in temperature. The entropy of surface formation was found to decrease with concentration in most cases.

1. Introduction

Surface tension is an intrinsic property of some liquids that has been known for a long time. Surface tension of liquids, in particular water, is affected both positively and negatively by the addition of surfactants and electrolytes. Surface tension plays very important role in the understanding of molecular interactions that exist on the surface and in the bulk of liquids [1]. Liquid–liquid extraction, such as hydrometallurgy, and liquid–liquid dispersion processes are greatly affected by liquid surface tension. The importance of surface tension measurements has been stressed recently due to its consideration in numerous technological and scientific areas. For example quantitative data on surface tension of liquids are required for solving many engineering related problems. Similarly, the quality of many industrial products is determined by surface tension in the field of chemical engineering. In gas absorption processes at gas-liquid interfaces the mass transfer rates are greatly affected by surface tension of liquids [2].

Surface tension of aqueous inorganic salt solutions have shown marked specific ion effects that had remained an ambiguous and unexplained fact. The surface tension of inorganic salt solutions increases with the increase in concentration. This increase in surface tension has been correlated with the structure of the

* Corresponding author. Tel.: +92 91 9216652/9216701x812; fax: +92 91 9216652.
E-mail address: shah@s2004.tu-chemnitz.de (A.-u.-H.A. Shah).

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http://dx.doi.org/10.1016/j.colsurfa.2012.10.054