

Nº748 / PC

TOPIC(s) : Alternative technologies / Alternative solvents

## Bio-based ionic liquids as extraction-preservation strategies in RNA bioprocessing

### AUTHORS

Mara G. FREIRE / CICECO, CHEMISTRY DEPARTMENT, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO

Maria J. QUENTAL / CICECO, CHEMISTRY DEPARTMENT, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO

Augusto PEDRO / CICECO, CHEMISTRY DEPARTMENT, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO

Patrícia PEREIRA / ITQB - INSTITUTE OF BIOLOGICAL CHEMISTRY AND CHEMICAL TECHNOLOGY, NEW UNIVERSITY OF LISBON, AV. DA REPÚBLICA, OEIRAS

Mukesh SHARMA / CICECO, CHEMISTRY DEPARTMENT, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO

João A. QUEIROZ / CICS-UBI - HEALTH SCIENCES RESEARCH CENTRE, UNIVERSIDADE DA BEIRA INTERIOR, COVILHÃ, COVILHÃ

João A. P. COUTINHO / CICECO, CHEMISTRY DEPARTMENT, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO

Fani SOUSA / CICS-UBI - HEALTH SCIENCES RESEARCH CENTRE, UNIVERSIDADE DA BEIRA INTERIOR, COVILHÃ, COVILHÃ

### PURPOSE OF THE ABSTRACT

Nucleic acids are powerful biological tools in several fields [1], ranging from fundamental to applied research. However, the ubiquitous instability of ribonucleic acid (RNA) along with issues associated to its purity degree have been preventing its widespread use as low-cost biotherapeutics. Based on the well-known capacity of amino acids to specifically interact with RNA when used as ligands in chromatography [2], a set of amino-acid-based ionic liquids (AA-ILs) was herein investigated, both to act as preservation media and as phase-forming agents of aqueous biphasic systems (ABS) to carry out the biopolymer extraction from real matrices. AA-ILs comprising the cholinium cation and anions derived from L-lysine ([Ch][Lys]), L-arginine ([Ch][Arg]), L-glutamic acid ([Ch][Glu]) and DL-aspartic acid ([Ch][Asp]) were studied for this purpose. This work proved that the stability of RNA is preserved in aqueous solutions of AA-ILs, even in presence of ribonucleases (RNases). It is also demonstrated that these AA-ILs display no cytotoxicity onto two distinct human cell lines. After ensuring the stability of RNA in presence of AA-ILs and protection against RNases, ABS formed by AA-ILs were applied in the extraction of RNA from a bacterial lysate sample, showing that RNA can be successfully extracted to the IL-rich phase, which can also act as a preservation medium. RNA can be recovered by alcohol precipitation and the IL reused, contributing to the development of an integrated and sustainable extraction-preservation process for nucleic acids toward the current critical demand of high-quality/high-purity biotherapeutics.

### Acknowledgments:

The authors acknowledge to the CICS-UBI projects supported by FEDER funds through the POCI - COMPETE 2020 (Project POCI-01-0145-FEDER-007491) and National Funds by FCT (Project UID/Multi /00709/2013), and to the project CICECO-Aveiro Institute of Materials, FCT Ref. UID/CTM/50011/2019, financed by national funds through the FCT/MCTES. The work was also supported by the project POCI-01-0145-FEDER-029496, co-financed by FEDER, through POCI - Operational Programme Competitiveness and Internationalization, and

National Funds by FCT - Foundation for Science and Technology. P. Pereira acknowledges a post-doctoral fellowship from a FCT-funded project (Ref: PTDC/1399/2014), and M. V. Quental the FCT PhD grant SFRH/BD/100155/2014.

## FIGURES

FIGURE 1

FIGURE 2

---

### KEYWORDS

ribonucleic acid | ionic liquids | aqueous biphasic systems | integrated processes

---

### BIBLIOGRAPHY

[1] J. Lieberman, *Nat. Struct. Mol.*, 2018, 25, 357-364.

[2] P. Pereira, A. Sousa, J. Queiroz, A. Figueiras and F. Sousa, *J. Chrom. A*, 2014, 1331, 129-132.