Screen the best ionic liquids for keratin dissolution by using COSMO-RS

Liu, Xue; Nie, Yi; Zhang, Suojiang; Skov, Anne Ladegaard

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Screen the best ionic liquid for keratin dissolution by using COSMO-RS

Xue Liu(1)(2), Yi Nie(2), Suojiang Zhang(2)*, Anne Ladegaard Skov(1)*

(1) Danish Polymer Centre, Department of Chemical and Biochemical Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark;
(2) CAS Key Laboratory of Green Process and Engineering, Institute of Process Engineering, Chinese Academy of Sciences, Beijing, China;
• Most PDMS used in tissue engineering applications are nonpolar, inert and highly hydrophobic, which lead to the low biocompatibility and interaction responses between implantations and cells.

Keratin molecules have many inter- and intra-molecular strong bonds and also have no regular repeating units, which lead to it difficult to be dissolved by traditional solvent.

Keratin has the special amino acid sequence for cell adhesion, which can increase susceptibility to bio-decomposition.

Keratin can improve the mechanical properties of composites.

Keratin dissolution in ionic liquids

Ionic liquid (IL) is a salt in which the ions are poorly coordinated, which results in these solvents being liquid below 100°C, or even at room temperature.

Properties of ILs
- High chemical stability and thermal stability
- Wider liquid state, Non-volatile
- Low vapor pressure
- Tunable structure and properties
- Wide electrochemical windows
- High electrical conductivity

Advantages of ILs in dissolving keratin
- Higher solubility
- It can be recycled with high recovery rate
- Less damage to keratin structure
- Tunable structure and properties

Study of keratin dissolution in ionic liquids

<table>
<thead>
<tr>
<th>Author</th>
<th>ILs</th>
<th>Temperature °C</th>
<th>Time</th>
<th>Solubility</th>
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<td>Yimei A</td>
<td>[Bmim][Cl],Na2SO4, H2O</td>
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<td>1h</td>
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<td>Haibo Xie</td>
<td>[Bmim][Cl], [Bmim][Br]</td>
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<td>10h</td>
<td>11</td>
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<td>Yuxia Wang</td>
<td>(HO2Nime)[NT4],NaHSO4</td>
<td>80</td>
<td>4h</td>
<td>ND</td>
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<tr>
<td>Aleia Idris</td>
<td>Bis(2-ethylhexyl) ammonium[thiophylolate]</td>
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<td>10h</td>
<td>45</td>
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<td>Shuangbing Zhang</td>
<td>[Bmim][PF6]</td>
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<td>24h</td>
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</table>

It is nevertheless a challenge to identify the best ILs for keratin dissolution;
Experimental measurement of all these systems is not practically feasible;
A rapid and a priori screening method to predict the keratin solubility capacity for ILs is needed.
Screen the best ionic liquid for keratin dissolution by using COSMO-RS

Xue Liu (1,2), Yi Nie (2), Sunjiang Zhang (2), Anne Ladegaard Skov (1)*

(1) Danish Polymer Centre, Department of Chemical and Biological Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark
(2) CAM Laboratory of Process Engineering, Institute of Process Engineering, Chinese Academy of Sciences, Beijing, China

Abstract

Keratins, the most abundant protein in the animal kingdom, have a multitude of applications in the fields of biomedicine and biotechnology. However, the solubility and dissolution of keratin is a significant challenge due to its unique properties, and the study of keratin dissolution is crucial. In this study, we have evaluated the solubility of different keratins in various ionic liquids by using COSMO-RS. The results show that the solubility of keratin in ionic liquids can be significantly enhanced by increasing the ionic strength of the medium. Among the ionic liquids tested, 1-ethyl-3-methylimidazolium acetate (EMIMAc) shows the highest solubility for keratin, while 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide (EMIMTFSI) shows the lowest solubility. These results provide valuable insights into the design of efficient ionic liquids for keratin dissolution.

1. Application of keratin in elastomer materials

2. Structures of 1s and keratin models in this study

3. Predict result

4. Conclusions and Advances

Acknowledgments

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References


Thank You!