Carbohydrate Polymers 298 (2022) 120138



Contents lists available at ScienceDirect

Carbohydrate Polymers

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



Review



Imidazolium based ionic liquids modified polysaccharides for adsorption and solid-phase extraction applications: A review

Ismaila Olalekan Saheed [a,b], Samsudeen Olanrewaju Azeez [b], Faiz Bukhari Mohd Suah [a,*]

[a] Green Analytical Chemistry Laboratory, School of Chemical Sciences, Universiti Sains Malaysia, 11800 Minden, Pulau Pinang, Malaysia
[b] Department of Chemistry and Industrial Chemistry, Kwara State University, Malete, P.M.B 1530, Ilorin, Nigeria

ARTICLE INFO

Keywords:
Adsorbent
Cellulose
Chitosan
Polysaccharides
Ionic liquids
Solid-phase extraction

ABSTRACT

Attempt to broaden the application of ionic liquids (ILs) towards synthesis and modification of polysaccharides as adsorbent have gained more attention in the last two decades. This development has been aimed mainly on the use of environmentally friendly chemicals for improving the physical, chemical and adsorptive features of polysaccharides-based adsorbents for various applications. In the build-up to improve the polysaccharides-based adsorbents' characteristics through modification, ILs have been utilised by researcher either as a solvent medium or as a component of the modified natural polymer-based adsorbent. Findings revealed that the imidazolium-based ILs have been the prominent ILs type utilised for polysaccharides modification owing to its ease of preparation and its solvation capability for most commonly applied natural polymer. This review uniquely summarised the trend in the use of imidazolium based ILs to improve the adsorptive features of various polysaccharides adsorbents for adsorption and solid-phase extraction applications.

1. Introduction

Polymers are giant molecules that comprise of repeating units of a monomer or dissimilar monomers in a linear or interconnected structural arrangement. Their physical characteristics including thermal and mechanical properties depend on their length, specific gravity and composition. Polymers are natural or synthetic materials, and could either be biodegradable or non-biodegradable. The biopolymer based adsorbent materials such as lignin, chitosan, cellulose, hemicelluloses, alginate, etc., offers a significant role in adsorption application due to their biocompatibility, biodegradability, recyclability, reabsorbability (Ahmad et al., 2017). In lieu of this, the interest driving in the path of producing natural polymer composites has gained attention in the last few decades owing to their sustainability and degradability matters (Nurazzi et al., 2021). The challenge on the use of polymer based adsorbents for various applications such as adsorption purpose and solid-phase extraction (Raoov, Mohamad, Bin Abas, et al., 2014; Yan, Gao, et al., 2014) of contaminants include, low adsorption capacities (Tang et al., 2013), relatively weak interactions and difficulties of separation and regeneration (Vakili et al., 2019). Efforts have been made to overcome these adsorbents' limitations through various polymer modifications such as fabrication of organic-inorganic hybrid polymers (Samiey et al., 2014), molecularly imprinted polymer (Ma & Row, 2018; Yan, Yang, et al., 2014), polymer composites (Wang et al., 2019; Wang et al., 2009) and functionalised polymers (Gao et al., 2013; Tang et al., 2021).

Various biosynthesis routes have produced polymers such as proteins, polysaccharides nucleic acids, polyesters, polyisoprene, polyethers (lignin), and some other complex polyaromatics compounds (Gomez-maldonado et al., 2019). Utilisation of natural polymers minimizes the complex industrial synthetic routes, and the purification could be accomplished with the aid of a more environmental friendly solvents system (Gomez-maldonado et al., 2019). Polysaccharides are well-known naturally abundant polymers (such as cellulose and chitin) that are cheap and easy to extract, and have been modified and utilised for adsorption (Bhatnagar & Sillanpää, 2009; Saheed et al., 2021a) and solid-phase extraction applications. Chitin is deacetylated to chitosan (Yong et al., 2018), which also retains the properties (such biocompatibility, biodegradability) that are favourable for environmental and biomedical applications (Mittal et al., 2018). Alginate is another polysaccharide with good water absorption ability due to its richness in carboxyl groups. Alginate and chitosan can be modified to hydrogels, beads and composites (Gomez-maldonado et al., 2019). Cellulose on the other hand often exists as networks or fibres having intermolecular hydrogen bonding interactions between the hydroxyl groups (Patil et al.,

* Corresponding author.
E-mail address: fsuah@usm.my (F.B.M. Suah).

https://doi.org/10.1016/j.carbpol.2022.120138
Received 12 June 2022; Received in revised form 11 September 2022; Accepted 18 September 2022
Available online 21 September 2022
0144-8617/© 2022 Elsevier Ltd. All rights reserved.