AIR TEMPALTED MACROPOROUS LIGNIN FOAMS

Mohammad Jalalian, Qixiang Jiang, Alexander Bismarck

Institute of Material Chemistry & Research, University of Vienna, Austria

Mechanical frothing air into monomers is a new technique that can be used to create gas-liquid foam templates which can be subsequently polymerised to produce macroporous polymers [1]. The original purpose of our study was to efficiently prepare sustainable porous materials by taking into account the principles of green chemistry. Conventional polymer foams are produced by chemical or physical blowing. Therefore, here we report polymer foams prepared by curing air foam templates. The air templating method is superior to emulsion templating due to the fact that air-templated foams do not need purification or removal of the liquid template phase. This advantage, combined with the low cost materials, provides a cost-effective strategy for the production of macroporous polymers.

We used black liquor (BL) as starting material to produce lignin foams. BL is an aqueous alkaline mixture containing dissolved degraded lignin and hemicellulose fragments coming from wood that was digested during the kraft process [2]. BL was mechanically whipped into liquid froth and subsequently crosslinked in the continuous phase using epichlorohydrin to produce macroporous lignin foams. We report an approach to produce macroporous lignin foams with high porosity (85-95%). The foamability of the liquid BL was investigated by varying the concentrations of BL and the frothing energy. The physical, mechanical and thermal properties of the resulting lignin foams were characterised. It was found that mechanical frothing, which is intrinsically scalable, provided a means for fabrication of environmental friendly macroporous bio-based polymer foams.

[1] K.-Y. Lee, L.L.C. Wong, J.J. Blaker, J.M. Hodgkinson, A. Bismarck, Green Chemistry 13 (2011) 3117.

[2] S. Yokoyama, In the Asian biomass handbook–a guide for biomass production and utilization, in: S. Yokoyama, Y. Matsumura (Eds.), The Japan Institute of Energy, 2007, <http://aba.jie.or.jp/aba_handbook.htm>.