Oligoetherols synthesized from 6-aminouracil, boric acid and ethylene carbonate as potential ingredients for the production of polyurethane foams with improved thermal stability and reduced flammability

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1. Introduction – Thermal resistance and flammability of polyurethane foams are considered as the most important problems for applications of this foams as insulating materials. The thermal stability of foams can be improved by using a polyol component containing in their structure heat-resistant heterocyclic rings, e.g. 1,3-pyrimidine ring [1-3]. Flammability can be reduced by incorporating organic compounds with boron atoms [4, 5]. One of the methods is the use of poly- or oligoetherols containing in their structure this atoms [6]. Here, a synthesis of oligoetherols with a 1,3-pyrimidine ring and boron atoms using 6-aminouracil, ethylene carbonate and boric acid has been proposed.

2. Experimental - In the first stage, reaction of 6-aminouracil with ethylene carbonate is carried out for four hours at 160°C in the presence of potassium carbonate as a catalyst [7]. Ethylene carbonate is employed as both reagent and solvent. 4 moles of ethylene carbonate per mole of 6-aminouracil is used - it is the minimum amount of carbonate needed to block reactive groups of 6-aminouracil (nitrogen atoms in the ring, an amino group). Next, the boric acid (3 or 4 moles) and ethylene carbonate (12 or 14 moles) is added to the obtained hydroxyethyl derivative of 6-aminouracil and the reaction mixture is heated at 120° C for four hours. After this time, the catalyst (potassium carbonate) is added and the temperature is increased to 160° C.

3. Results and Discussion - The structure of the obtained products was determined by instrumental methods (IR, ^{1}H-NMR and MALDI-ToF spectra). A chromatographic analysis of the obtained oligoetherols was performed to identify and estimate the content of ethylene glycol and its products of secondary reactions with ethylene carbonate. The physicochemical and thermal properties of oligoetherols were examined. The products were characterized by high thermal stability. Preliminary foaming tests were carried out using the obtained oligoetherols as polyol components.

4. Conclusions - Based on the tests performed, it was found that polyols obtained from 6-aminouracil, boric acid and ethylene carbonate are suitable for manufacturing of polyurethane foams with improved thermal stability and reduced flammability.

5. References

[1] E. Chmiel-Szukiewicz, *J. Appl. Polym. Sci.*, **109**, (2008) p 1708.
[2] E. Chmiel-Szukiewicz, *Polimery*, **55**(1), (2010) p 817.
[3] E. Chmiel-Szukiewicz, *J. Appl. Polym. Sci.*, **127**, (2013) p 1595.
[4] B. Czupryński, J. Paciorek-Sadowska, J. Liszkowska, *Polimery*, **47**(10), (2002) p 727.
[5] J. Paciorek-Sadowska, B. Czupryński, J. Liszowska, *J. Appl. Polym. Sci.*, **118**, (2010) p 2250.
[6] J. Lubczak, B. Łukasiewicz, *Chemik*, **67**(4), (2013) p 275 (in polish).
[7] E. Chmiel-Szukiewicz, *J. Appl. Polym. Sci.*, **106**, (2007) p 3703.