



## Effect of ethanol on the hydrothermal liquefaction process and chemical recovery of different polyurethane wastes

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### Abstract

Polyurethanes (PUs) are industrially important polymeric materials that have various applications in different sectors. However, their chemical recycling is a challenging task due to the stability of their urethane linkages, which resist hydrolysis and other degradation reactions. In this study, we propose to use hydrothermal liquefaction (HTL) as a novel method to recycle PUs in mild conditions using ethanol and water as solvents. We investigated the effect of ethanol percentage (0%, 10%, 30%, and 50% w/w) and reaction temperature (200-300°C) on the decomposition and oil recovery of three different types of PUs: foam, quinoline-based, and highresistance. We conduct the HTL experiments in a batch microreactor with a PU to solvent ratio of 1:10 and a reaction time of 10 min. We separate and analyze the liquid and solid products by filtration, washing, evaporation, and GC-MS. The results show that ethanol significantly enhances the degradation rate of all PUs, especially at low temperatures, but reduces the oil yield. The main product in the oil and water phases is 4,4-methylenedianiline (MDA), which accounts for 50% of the relative peak area in the GC-MS analysis. The optimum ethanol concentration for oil production and decomposition rate is 10% and 30% w/w, respectively. HTL is an effective and environmentally friendly method to recycle PUs in mild conditions and produce valuable chemicals.

**Keywords:** Decomposition, HTL, Polyols, Polyurethane, Recycling