

Title Physicochemical characteristics of densified untreated and steam exploded poplar wood and wheat straw grinds

Author M.D. Shaw, C. Karunakaran and L.G. Tabil

Citation Biosystems Engineering, Volume 103, Issue 2, June 2009, Pages 198-207

Keywords wheat; physical quality

Abstract

The effect of steam explosion pretreatment, process (die) temperature, feedstock particle size, and moisture content was evaluated on the physical quality of pellets produced from poplar wood and wheat straw. Following feedstock preparation, which involved either pretreatment and moisture conditioning (9 and 15%, wet basis) or grinding (0.8 and 3.2 mm hammer mill screens) and moisture conditioning, the materials were compressed in a plunger–die assembly with a force of 4000 N. The resulting pretreated pellets had a higher density and tensile strength than the untreated. Also, the pretreated pellets experienced a dimensional reduction after 14 days, whereas the untreated pellets expanded in the diametric and longitudinal axes. Pretreated wheat straw generally had a higher pellet density, higher tensile strength, and higher dimensional reduction than the pretreated poplar pellets. Conversely, the untreated poplar pellets had a higher pellet physical quality than the untreated wheat straw pellets. Increasing the die temperature (from 70 to 100 °C) and decreasing the feedstock particle size (from 3.2 to 0.8 mm) increased pellet physical quality. The effect of moisture content on pellet physical quality varied with the levels of other factors (die temperature and particle size). Using Fourier Transform Infrared Photoacoustic Spectroscopy, it was found that the lignocellulosic structure was disrupted by pretreatment. The resulting higher relative percentage, and availability, of lignin was attributed to the increased quality of the pretreated feedstock pellets.