Effect of gliadin-glutenin ratio on gluten network formation during thermomolding

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Gluten proteins can be applied for producing rigid biobased materials. We studied the effect of the gliadin-glutenin ratio on network formation and on the mechanical properties of the glassy end product after thermomolding. Samples with 7.0% moisture content and without additional plasticizer were processed at 130 and 150 °C for 5 and 25 min. Gluten proteins polymerized during thermomolding and polymerization was faster for glutenin than for gliadin. Gluten polymerization at 130 °C decreases the water absorption of thermomolded gluten. Gliadin-rich samples molded under the same experimental conditions as glutenin-rich samples absorb more water than the latter. The relative contribution of non-disulfide bonds to the gluten network increased with the molding temperature and was higher for glutenin-rich than for gliadin-rich samples. During thermomolding, β-elimination of cystine occurred. Dehydroalanine derived lanthionine cross-links were detected in molded samples in higher levels in glutenin-rich samples than in gliadin-rich samples. The elastic modulus of bioplastic materials, as determined with a 3-point bending test, did not depend on the molding temperature and time at any gliadin-glutenin ratio. However, the modulus increased with increasing gliadin-glutenin ratio. The latter could be related to the higher relaxation enthalpies for the gliadin-rich samples. For glutenin-rich samples the stress at break increased with increasing molding temperature and was correlated with the degree of cross-linking. For gliadin-rich samples the stress at break was independent of the molding conditions.