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## Effects of phosphorus-containing additives on soy and cottonseed protein as wood adhesives

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### Abstract

Soy and cottonseed proteins appear promising as sustainable and environment-friendly wood adhesives. Because of their higher cost relative to formaldehyde-based adhesives, improvement in the adhesive performance of proteins is needed. In this work, we evaluated the adhesive properties of soy and cottonseed protein formulations that included phosphorus-containing acids and esters. For cottonseed protein isolate, most of these additives improved dry adhesive strength, with methylphosphonic acid, phosphorous acid, and phosphoric acid increasing the dry strength by 47, 44, and 42%, respectively, at their optimal concentrations. For soy protein isolate, these additives did not show significant benefits. The phosphorus-containing additives also improved the hot water resistance of the cottonseed protein formulations but showed either no effect or a negative effect for the of soy protein formulations. Thus, the combination of cottonseed protein with phosphorus additives appears to be attractive as wood adhesives.

*Keywords:* Adhesive strength, cottonseed protein; phosphorus compounds; soy protein; water resistance; wood adhesive

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