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Effects of compound emulsifiers on properties of wood adhesive with high starch content

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ABSTRACT: Lauryl sodium sulfate (LSS) combined with alkylphenol ethoxylates (APEO) were used to enhance the performance of a high starch content wood adhesive (HWA). The optimal shear strength, mobility and viscosity stability of the wood adhesive after repeated freeze–thaw cycling were gained when LSS to APEO ratio was 7 to 1, which could efficiently solve storage problems caused by a high starch content. Through blue value and differential scanning calorimetry (DSC) analysis, it was proved that the structure of the complexes formed between amylose and the compound emulsifiers with LSS/APEO mixing ratio of 7:1 was the most stable. Scanning electron microscopy (SEM) images and particle size analysis showed that compound emulsifiers could significantly suppress the aggregation of emulsion particles. The mechanism could be, on the one hand, attributed to stable complexes formed by compound emulsifiers and amylose which could restrain starch retrogradation, and on the other to the synergetic effect of electrostatic charge forces and space steric hindrances caused by the LSS/APEO mixture adsorbed on the surface of latex particles. In conclusion, the addition of an LSS/APEO (mixing ratio 7:1) mixture could significantly prevent the aggregation of latex particles and retrogradation of starch molecules, indicating that these compound emulsifiers could be applied in the preparation of a high starch content wood adhesive.

Key words: Wood adhesive; High starch content; LSS; APEO; Storage stability

1. Introduction

With increasing use of engineered wood products, demand for wood adhesives has grown greatly in recent years [1]. Wood adhesives used today are mainly based on fossil resource, which is both limited and non-renewable [2]. Moreover, petroleum-derived urea-formaldehyde adhesives pose a potential hazard to the environment and human health [3]. Increasing concerns about the strong reliance on

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