ONTWIKKELING GROENE SCHUTCOLLOIDEN

(Development of protective colloids in emulsion polymer dispersion based on potato starch derivatives)

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Description of research

Emulsion polymer is one of the most studied subject in the field of polymers. They consist of hydrophobic polymer material which is created in water. The advantage of this process is that one can produce high molecular weight polymer with ease of handling due to their fluidity. Emulsion polymerisation is used to produce a wide range of products, such as adhesives, paints, additives for textile, paper, and construction materials, binders for non-woven fabrics, modifiers for plastics, and also for drug delivery systems [1].

Protective colloids and often also other additives, are required to stabilise emulsion polymers from coagulation. They create a boundary layer (steric hindrance) around the hydrophobic molecules in the water phase, see Figure 1. Example of well-known protective colloids used in this process are polyvinyl alcohol, hydroxyethyl cellulose, and modified starch [2]. Cellulose and starch are advantageous due to their biodegradability. However, the latter is preferable due to its easier recovery from natural renewable resources and easier processing.

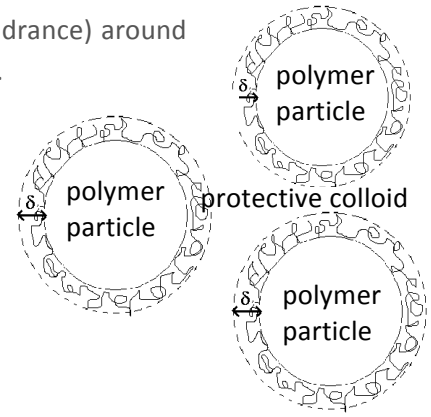

Figure 1 Protective colloid preventing coagulation

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In this research, emulsion polymerisation of vinyl acetate is studied in depth in conjunction with starch derivatives as the only protective colloid, without the use of other additives. The final latex product is suited for wood adhesive application. The aim of the work is to preliminarily investigate the use of a polymerisation process that closely resembles to industrial process conditions. The main focus is to understand the relationship between relevant process parameters and the characteristics of the final products. The polymerisation reaction was executed without removal of inhibitors (i.e. oxygen and hydroquinone). The impact on reaction conditions was monitored by the parameters such as headspace temperature, stirrer torque, and power consumption of the water bath. The viscosity of the obtained lattices ranges from 1,000 to 10,000 mPa*s and meet the wood bonding criterion of DIN EN 204 D2 (moisture resistant, indoor) easily. In addition, an insight of how the starch stabilises the emulsion polymers, by means of isolation and characterisation of the grafting site, has been investigated.

References:

[1] J.M. Asua, Emulsion Polymerization: From Fundamental Mechanisms to Process Developments, *J. Polym. Sci. Part A: Polym. Chem.*, **2004**, *42*, 1025-1041.

[2] C.P. Iovine, Y. Shih, P.R. Mudge, P.T. Trzasko, Hydrophobically modified starch stabilized vinyl ester polymer emulsions. European Patent Application no. 0,223,145 A1, **1987**.

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