Effect of Plasticizer and Emulsifier on Synthesis of Ethylcellulose Aqueous Dispersion

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Abstract: Ethylcellulose (EC) latex was prepared by phase transfer process. The results show that both the particle size and viscosity decreased and then increases gradually with the increases of emulsifier concentration. The condensate rate of the latex was found to decrease with the enhancement of plasticizer concentration.

Key words: Ethylcellulose latex; plasticizer; emulsifier
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Ethyl cellulose is hydrophobic and has been successfully used in commercially available aqueous coating dispersions[1]. Aqueous polymer dispersions are widely used for application in controlled-release delivery systems. Aqueous dispersions have been preferred over organic solutions for film coating processes with safety and environmental concerns and a lower viscosity at the same solids content. Organic methods are disadvantageous because the solvent is expensive, hazardous and difficult to recover for reuse. Further, residual solvent often left in the polymer and impairs polymer properties. Furthermore, if large quantities of solvent are not used in such direct dispersion methods, a very difficult mixing problem is presented which requires high temperatures and intensive agitation[2-4]. In the present study, a process, which can produce a complete plasticized aqueous dispersion, namely Y, was developed. Dibutyl sebacate was used as a plasticizer. The project aims at: (1) investigating the effects of the amount of plasticizers on properties of Y; (2) comparing the results with ethyl cellulose latex in reference[5].

1 Experimental

1.1 Materials

Dibutyl sebacate (DBS) was supplied by National Chemical Reagent Co. Ltd. Oleic Acid and ammonia water were obtained from Yingdaxigui Chemical Company of Tianjin. Ethyl cellulose was purchased from the Chemical Plant of Luzhou in China. Surelease was supplied by Colorcon, USA.

1.2 Experiment and testing

EC was mixed with DBS by mixer with rotation speed of 30 r·min^{-1} and then granulated by Brabender extruder over the temperature range of 50 ~ 100℃. EC latex was prepared with phase transfer process. Particle size of latex was assessed using a laser light scattering spectrometer, 90 plus particle size analyzer. The latex was diluted to 1‰ before assessing the particle size, and then film was made on a piece of glass. It was examined by Atomic force microscope (AFM), JSPM-5200, JEOL. For the measurement of curing rate 1 g of EC latex was used. The sample was placed in container and dried in oven at 60℃ until reproducible weight was obtained.

2 Results and discussion

2.1 Effects of emulsifier on latex diameter and viscosity

Oleic Acid and ammonia water was used as emulsifier. The particle sizes of all latexes were in the range of 93 ~ 300 nm. Fig. 1 shows that the particle size decreases first and then increases as the emulsifier concentration increase. Similar profiles were obtained for the latex viscosity. In addition, it is observed that both particle size and latex viscosity were found to minimum simultaneously with the proportion of 2% weight emulsifier in plasticized EC. According to the concepts of phase continuity the latex viscosity correlation with the particle size, optimal polymer particle packing (with minimal void volume) are achieved when small particles form a continuous phase surrounding the large particles. For polymer particle size ratio, there is a particular minimum volume fraction of the small particles,

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which is required to form this continuous phase. Fig.2 indicates that our lab EC aqueous dispersion particle size is smaller and more sophisticated comparing with the material (surelease) in reference. The surface area of surelease is 163 nm, while our lab material surface area is 93 nm.

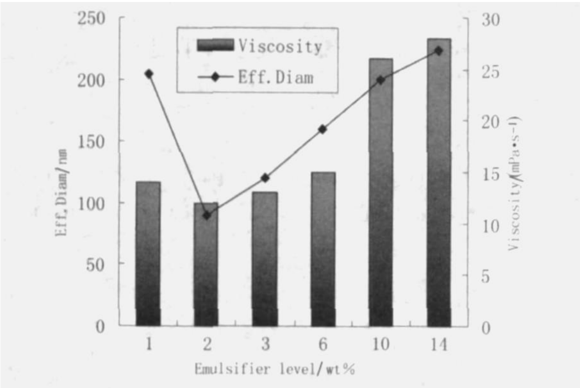

Fig.1 Effect of emulsifier on latex diameter and viscosity

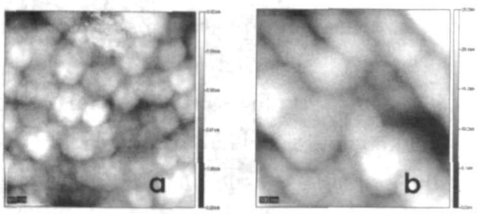

Fig.2 AFM images of particles of our lab material (a) and reference material (b)

2.2 Effects of plasticizer on curing rate

The influence of DBS concentration is shown in Fig.3. The same figure illustrate that curing rate decreases with increasing the amount of DBS quantity. The same curve demonstrates that plasticizer restrict the evaporation of water in the latex system, therefore, the film cured slowly.

3 Conclusions

The results lead to a conclusion that both the particle size and viscosity decreased and then increases

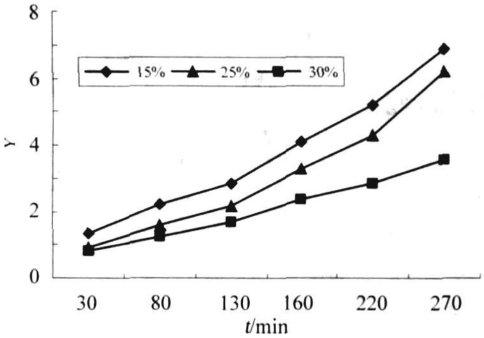

Fig.3 Effects of plasticizer on curing rate

gradually with the increases of emulsifier concentration. In addition, it was testified that plasticizer restrict the evaporation of water in the latex system. Our lab EC aqueous dispersion particle size is smaller and more sophisticated than those of sureleas.

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增塑剂和乳化剂对乙基纤维素水分散体制备的影响

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摘 要：用相转变法制备乙基纤维素水分散体，研究结果表明，随着乳化剂用量的增加，水分散体的粒径和粘度均呈先下降后减小的趋势。固化速率随着增塑剂含量的增加而下降。

关键词：乙基纤维素水分散体；增塑剂；乳化剂
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