White Pitch의 제어를 위한 코팅 파지의 처리기술

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Introduction

Deposits called white pitch relate to coated broke. This term is defined as a deposit which is formed from agglomeration of binder. Analyses of deposits show that the main component is latex. The rest of the deposit consists of pigment, fibers, and hydrophobic material such as pitch, defoamers, sizes, and stickies from deinked pulp.

Most of inorganic pigments are originated from coating layer and surfaces of inorganic pigments exist in broke stock are usually covered by insoluble hydrophobic synthetic binder, SB latex.

As a major coating binder for paper coating, SB latex is usually mixed in coating formula more than 10 parts and forms binder film between pigments. After reslushing of coated broke, SB latex covered pigments are dispersed in reslushed stock. They show hydrophobic surface properties although pigments themselves are hydrophilic and have a strong tendency to cause white pitch.

Materials and Methods

Actually SB latex contains comonomers and modifiers: for example methyl methacrylate and hydroxyethyl acrylate. These components in SB latex have ester bonds which could be hydrolyzed by lipase. Hence the hydrophobicity of latex-covered pigments is to be decreased by enzymatic hydrolysis of ester bond and alcohol generation.

In order to investigate the lipase applied modification of inorganic pigments originated from coated paper, surface hydrophobicity of coated paper was checked before and after the soaking in varied lipase solutions. If lipase could change the contact angle of a water drop on coated paper from hydrophilic to hydrophobic, soaking in lipase solution could be believed to promote the hydration of reslushed coating pigments in broke stock.

Coated paper (100g/m2, Ash 45%) having composition of coating as shown in Table 1 was soaked in three kinds of 0.1% lipase solutions for 30 min at the room temperature with agitation by a magnetic stirrer.

Table 1. Composition of the coated paper tested (%)

Ground calcium carbonate	85
American clay	5
Styrene butadiene latex (MMA 5 part, HEA 1.5 part)	8
Esterfied starch	2
Optical brightening agent	Trace
Violet dye	Trace
Ammonium Hydroxide	Trace

Lipase treated coated papers were rinsed and dried in the air in order to analyze the hydrophobicity of its surface. Dynamic contact angle of a water drop was measured before and after the lipase treatment.

In order to confirm the effect of lipase on the modification of SB latex film attached coating pigments, SB latex coated plastic film was prepared as follows. At first, SB latex emulsion was coated on plastic film with a coating weight of 10g/m2 and dried at the temperature of 105℃. The prepared latex coated film was soaked in 0.1% lipase 1 solution for 30 min at the temperature of 45℃with agitation by a magnetic stirrer.

For the consideration of possible influence originated from additives in commercial lipase, coated plastic film was soaked in deactivated lipase 1. In order to deactivate the enzyme activity of lipase 1, NaOCl was added as much as 5% based on enzyme weight. Lipase treated plastic films were rinsed and dried in the air for the analysis of hydrophobicity of its surface.

Result and discussion

As shown in Fig. 1. contact angle of water drop on coated paper soaked in water maintained more than 80°while the contact angle of coated paper soaked in lipase 1 and 2 solutions were decreased to below 60°. It means certain hydrophobic components, for example MMA or HEA in coating layer could be changed by lipase applied reaction. Although lipase 1 and 2 changed the hydrophobic surface of the coated paper into hydrophilic one, lipase 3 did not give any significant effect on the decrease of the contact angle of a water drop on the coated paper.

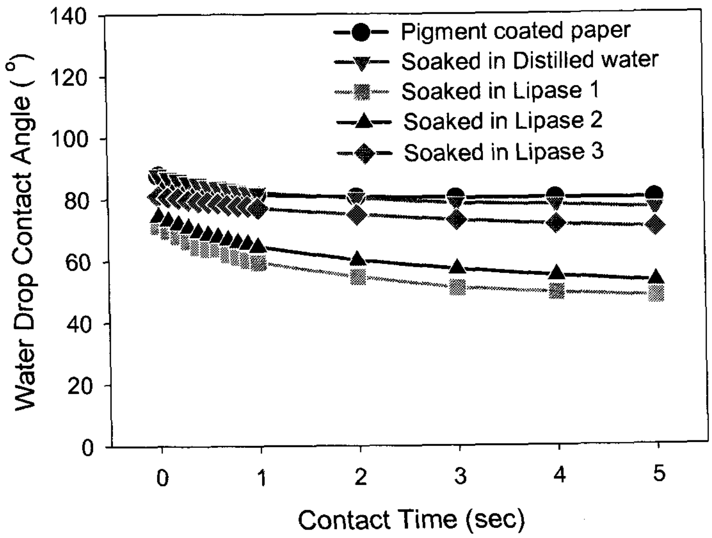

Fig. 1. Dynamic water drop contact angle of pigment coated paperaccording to the varied lipase treatment.

Fig. 2 shows dynamic contact angle of water drop on the coated plastic film soaked in normal and deactivated lipase 1. Lipase 1 changed the hydrophobic surface of the latex coated film into hydrophilic one while deactivated lipase 1 did not cause any change. The contact angle of the plastic film soaked in deactivated lipase 1 was similar to that of distilled water. This means lipase solution is useful to change the surface chemical properties of SB latex film and lipase plays decisive roll in this change without any significant influence from additives in enzyme solution, for example surfactants or other stabilizers.

Dealcohol mechanism of MMA and HEA by lipase could be suggested as Fig. 3. According to the hydrolysis of ester bonds in methyl methacrylate and hydroxyl ethyl acrylate and the generation of carboxylic acid, the hydrophobicity of latex-covered pigments is expected to be changed into hydrophilic.

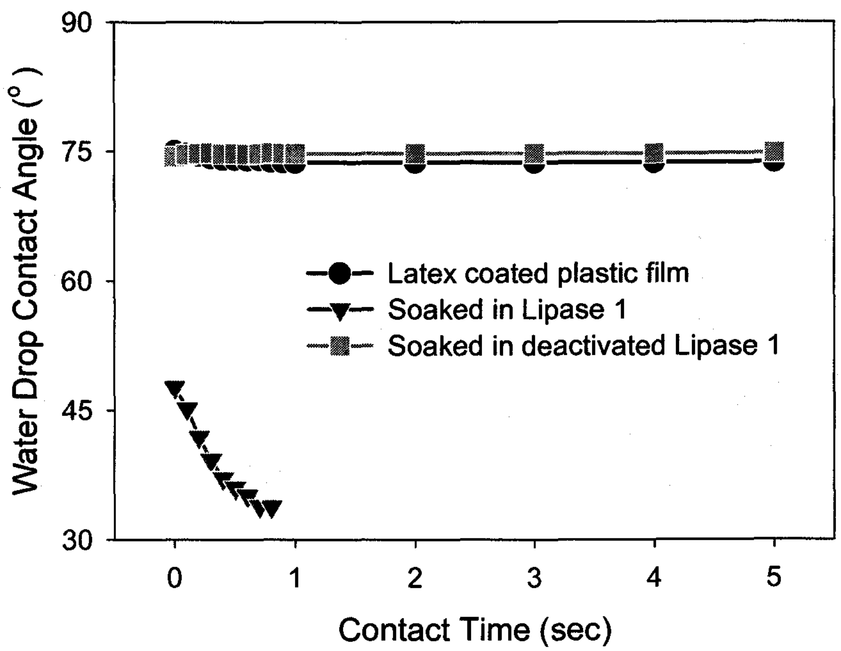

Fig. 2. Dynamic water drop contact angle of SB latex coated plastic film according to the lipase and deactivated lipase treatment.

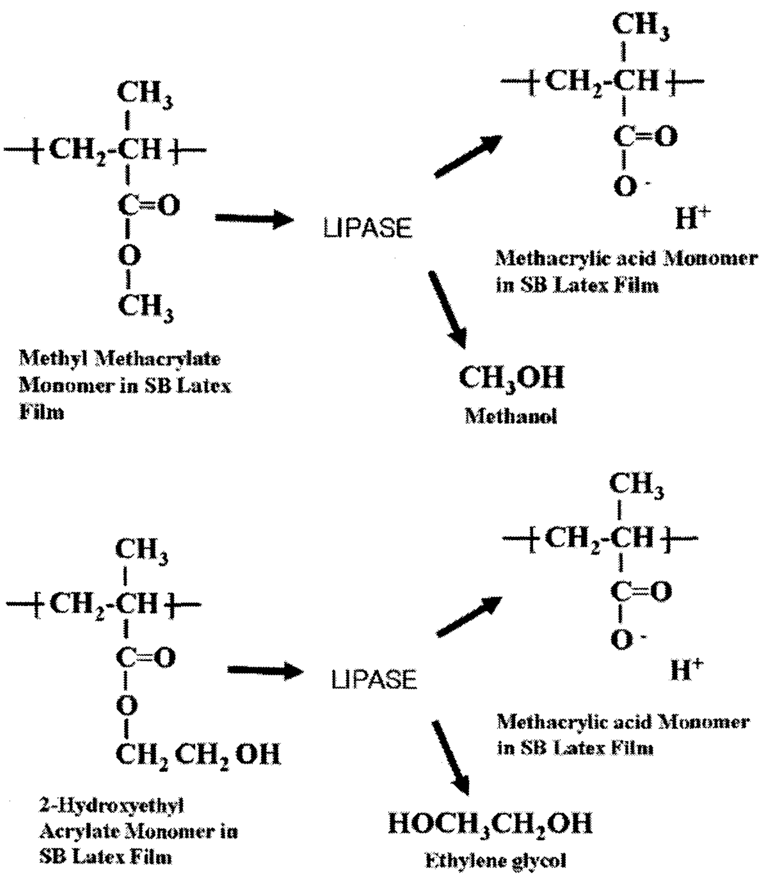

Fig. 3. Lipase applied dealcohol of MMA and HEA.

Conclusions

Lipase from Thermomyces lanuginosus showed dealcohol effects and it could be applied to promote hydration of SB latex film on coating pigments. As we can control the degrees of hydration by modifying the hydrophobicity of fine materials in broke stock through enzymatic treatment, reduction of white pitch could be pursued without the excessive introduction of fixing agent or cationic polyelectrolyte.