Study on the Effects of Pulp and Coating Color Co-Binder on the Optical Brightening Agent Added Unfilled White Paper

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ABSTRACT

ABSTRACT In order to maintain a global competitive capability, paper mills are dedicated to producing products that meet the specification of their clients while having increased bulk, decreased fiber content and optimal performance. In this regard, utilizing high yield bleached chemithermomechanical pulp (BCTMP) allows for bulk and opacity increases. Incorporating the pulp, however, risks the problems of color reversion and lower brightness and whiteness because of the high lignin content in BCTMP. The problems can be ameliorated through changing stock blend, coating or adding optical brightening agent (OBA). We hope to find laboratory formulation and operational conditions in wet-end additives and coating colors that have good brightness enhancing efficacies. Thus, the paper industry may benefit from the referential values of the thesis. The experimental work mainly divided into OBA applications in wet-end addition and in coating color formulation. Wet-end addition entailed addition of various OBAs to various pulp blends and examined their effects on brightness, whiteness, CIE L*a*b* values of the resulting handsheets and OBA retention on white water quality. In the coating experiment, a typical art paper formula was adopted, and the effects of using different types and dosages of OBAs with combination of 3 different co-binder formulation on calendered and UV irradiated coated sheet brightness, whiteness and CIE L*a*b* values were examined. When BSKP and BHKP blended with 15% BCTMP and 0.05% basic violet 10 (a shading dyestuff) was added 1.5% disulpho- and tetrasulpho-OBA, respectively, the brightness of the resulting paper (90.58%GE, and 89.83%GE, respectively) and whiteness (113.85%GE, and 106.40%GE, respectively) was the highest. The CIE L*a*b* values indicate that along with increasing BCTMP content and OBA dosages, the a* and b* also increased. An inflection point was noted at OBA dosages greater than 1.5%. With increasing UV irradiation time, the brightness and whiteness of the handsheets decreased; while the CIE L*a*b* showed decreased a* and increased b* values, tending toward a hue of green-yellow tone. Light-fastness of BCTMP is poor and yellows easily upon UV irradiation. Adding color fixative agent lowered brightness and whiteness of the handsheets, but helped retention of OBA. When BCTMP content increased from 10% to 30%, retention of OBA decreased. The coefficient of absorption (k) has an inverse correlation with the brightness or whiteness of the handsheets, and it correlated positively with fluorescent intensity. When we used CMC as a co-binder in combination with di-, tetra-, or hexasulpho-OBAs in coating, a 4% hexasulpho-OBA addition gave the best resulting coated paper brightness of 90.11% and whiteness of 92.20%. When co-binders starch, CMC and soy protein were blended with OBA, their effects on the brightness and whiteness of the coated paper were less marked. When the yellowish CMC was used as co-binder, the resulting whiteness was lower than those using starch or soy protein as co-binder. Calendering decreased the brightness and whiteness of the coated paper, but for coating color using CMC as co-binder, the calendaring effect was less notable than those using starch or soy protein as co-binder. After UV irradiation, both brightness and whiteness of the coated paper decreased, but again, the coating color using CMC co-binder showed less UV effect than those using starch or soy protein. The overall experimental results suggest that disulpho-OBA was suitable for wet-end application, and an addition cap of 1.5% was the most suitable for a blend of 20% BSKP, 65% BHKP and 15% BCTMP. Hexasulpho-OBA and Distyryl biphenyl-OBA were more suited to coating application, and the optimal dosage was 4%; while the di- and tetrasulpho types hit the limit at 2% dosages. When CMC was used as co-binder, it contributed to better brightness and whiteness, also better resistance to calendaring and UV irradiation. Key words : optical brightening agent, bleached chemithermomechan- ical pulp, yellowing, brightness, whiteness, co-binder, starch, carboxymethyl cellulose (CMC), soy protein.

Keywords : optical brightening agent ; bleached chemithermomechanical pulp ; yellowing ; brightness ; whiteness ; co-binder ; starch ; carboxymethyl cellulose (CMC) ; soy protein

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