

Effects of adding cationic polymeric aids, bentonite, and starch on the physical properties of corrugating medium made

葉慶隆、彭元興

E-mail: 321830@mail.dyu.edu.tw

ABSTRACT

Corrugating medium producers in Taiwan usually adopt locally collected old corrugated containerboard (TOCC) boxes as the raw materials. Due to the declining quality of heavily recycled stock, the entailing pulp suspensions often have poor drainage performance, inferior formation and poor strength properties that are problematic in meeting adequate quality standard and production efficiency. Most mills seek to add chemicals to amend the problems and to find the most economical and efficiency means of achieving enhanced ring-crushing and bursting strengths. In this study, a 23 factorial experimental design was adopted to examine the effects of adding cationic polyacrylamide (cPAM) retention aid, tapioca starch, and bentonite on the ring-crushing and bursting strength of the resulting medium paper and to determine the most favorable dosage levels in the handsheet forming process on those variables. The dosage levels examined were 100, 300, and 500 ppm for cPAM, 10, 12.5 and 15% for tapioca starch, and 3000, 6500, and 10000 for bentonite. The results indicated that cPAM, tapioca starch and bentonite exerted highly significant effects in boosting ring-crushing and bursting strengths. Tapioca starch significantly increased the first pass retention (FPR); the interaction of cPAM and bentonite significantly decreased white water COD; whereas, cPAM and bentonite alone also significantly improved drainage efficiency. The results also showed that the most optimal conditions for the ring-crushing and bursting strengths were cPAM at 100 ppm dosage, tapioca starch 15%, and bentonite 10000 ppm. These levels of addition resulted in ring-crushing strength increase of 62.5%, and bursting strength of 11%. The most favorable conditions for FPR improvement were 100 ppm of cPAM, 15% tapioca starch, and 3000 ppm bentonite which increased FPR by 6.5%. The most favorable conditions for COD abatement were 500 ppm of cPAM, 10% of tapioca starch, and 3000 ppm of bentonite which lowered COD by 13%. The most favorable conditions for drainage time were 300 ppm of cPAM, 12.5% of tapioca starch, and 6500 ppm of bentonite which shortened drainage time by 44%. The interactions of cPAM retention aid and bentonite showed no significant effect on ring-crushing and bursting strengths; indicating that individual addition of these chemicals was helpful to boost the strengths of corrugating medium, but adding them together, there was neither synergistic nor detrimental effect. The interaction between the cPAM and tapioca starch, however, showed significant enhancing effect on the ring-crushing and bursting strengths. Thus, adding them together further enhanced the synergistic effect on the strength properties. The interaction among the 3 variables indicated that adding them together showed significant boosting effects on the ring-crushing and bursting strengths

Keywords : corrugating medium, starch, polyacrylamide, bentonite, ring-crushing strength, bursting strength.

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