

Article

Evaluation of Recycled Paperboard Properties and Characteristics

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Abstract: Paperboard boxes represent a sought-after class of packaging products, where the use of recycled fibers offers a cost-effective and environmentally friendly alternative to virgin fibers. The presence of a significant proportion of recycled fibers in the paperboard leads to a number of limitations associated with the deterioration of its characteristics. In this study, the properties of coated and uncoated paperboards containing recycled fibers, wood pulp, and virgin cellulose fibers were investigated using a laboratory sample of paperboard produced from 100% recycled fibers without any chemical additives for comparison. Properties such as smoothness, bulk density, absorbency, and tensile strength, as well as colorimetric characteristics, were determined for the recycled paperboards; for the latter test, charts were printed using inkjet printing and UV-curable inks. Whiteness was calculated by three formulae (CIE, Berger, and Stensby), and all the paperboards had a relatively low whiteness (not exceeding 90 CIE), with a yellowish tint due to recycled fibers and mechanical pulp in the composition. The absence of optical brightening agents in the paperboards was experimentally confirmed. The color gamuts of the paperboards were in direct ratio to their whiteness, with the highest ones demonstrated by the coated paperboards. Color reproduction, according to the tone value increase curves, also depended on the whiteness. Uncoated paperboards demonstrated smaller color shifts than the coated ones, with the greatest increase in tone for yellow color. Coated recycled paperboards are suitable for packaging printing under the same conditions as virgin fiber boards, while uncoated boards are the recommended choice for digital printing with UV inks.

Keywords: recycled paperboard; colorimetric evaluation; whiteness; color gamut; inkjet printing; tone value increase



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1. Introduction

The pulp and paper industry is essential in providing various products for daily life. Despite facing challenges related to sustainable resource management [1], we are confident in the industry abilities to overcome them. The demand for raw materials, such as wood, leads to deforestation, which affects ecosystems and biodiversity. Furthermore, the production process consumes substantial amounts of water and energy, impacting environmental sustainability.

The industry is actively embracing innovation and sustainable approaches by adopting greener practices and implementing more efficient technologies to minimize the carbon footprint according to the principles of circular economy and environmental conservation [2]. The lack of eco-friendly pulpwood prompts consideration of chemical pulp derived from non-wood raw materials [3]. For instance, wheat straw [3], rapeseed [4,5], and corn stalks [6], among the other agricultural waste, have shown potential for the production of bio-based paper and packaging materials. Additionally, the concept of innovation entails

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