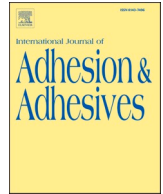




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## Development and performance of particleboard from various types of organic waste and adhesives: A review

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## ABSTRACT

Environmentally friendly or green building materials are more commonly used in the construction industry and furniture making industry. The knowledge of the environmental risks including the depletion of natural resources, the impact of pesticides, as well as the amplifier and enforcement criteria of good practice have led to an increase in the practice of recycling waste materials, and in particular, the recycling of abandoned trees in particleboard production. From the adhesive aspect, in view of future constraints of formaldehyde use, suitable alternatives to formaldehyde-based adhesive systems would have to be developed and implemented in the wood processing industry. The present review represents a critical appraisal of various organic wastes and adhesives used as raw materials in particleboard development. The core of this review is an assessment of physical and mechanical properties of particleboards based on various types of organic waste and adhesive. Based on these data, we evaluated their potential to identify suitable alternative raw materials having a certain probability to meet the requirements of a large-scale industry sector. Characteristics such as density, thickness swelling, modulus of rupture (MOR) and modulus of elasticity (MOE) are significant in the studies carried out by researchers worldwide. However, they also depend on the types of raw materials, adhesives, parameters and indicators used throughout particleboard production. As an overall conclusion, some organic wastes have the potential to replace wood fibers as raw materials in particleboard production with similar performances. Natural-based adhesives have also shown the potential to substitute formaldehyde-based adhesives in terms of performance. However, toxicological investigations should be performed before a decision can be made to ensure they are safe and add value as replacements for formaldehyde-based adhesives.

### 1. Introduction

Increasing perceptions of consumer needs and enhancing living standards of developed countries, particularly economically emerging countries like Asian countries, appear to have increased demand for wood products [1]. Research by Kibria et al. [2], showed that more than 3.5 billion tons of green wood is reportedly consumed worldwide. If the wood fiber consumed and the population growth rate remain stable, wood fiber consumption would increase by more than 60 million tons per annum. Such a large number can lead to rising deforestation which would have an immense detrimental effect on the climate [3]. As reported by Kozłowski & Helwig, a large portion of overall wood

consumption (0.36 billion cubic meters), was generated by the particleboard industry, and it is projected to be 0.47 billion cubic meters by 2010 [4]. However, according to the IMARC Group, the global market for particleboard shows that it will reach a total value of 21 billion US dollars in 2020. The group also expects a compound annual growth rate (CAGR) of particleboard will grow at 4.4% over the next six years [5].

In recent years, there has been a trend to recycle materials and deploy them to manufacture composite timber products such as particleboard. This effort is made on the basis of demand for wood supply, whether for the construction industry or for the production of furniture, due to the fact that wood supply from natural forests has declined. Furthermore, the initiative to use renewable biomass products as raw

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