

## Manufacture of Chipboard Panels from Indigenous Date Palm Bioma

**Talip Y. Alp and Faisal I. Iskanderany**  
*Faculty of Engineering, King Abdulaziz University*  
*Jeddah, Saudi Arabia*

### Introduction

Saudi Arabia is well known for its date production which ranks first amongst its agricultural products. Date palm trees grow in places where the ground water level is near the surface. In vast stretches of deserts and rocky lands, oases form the sights of greenery where date palm trees grow in abundance. Although it grows wherever water is available, major date plantations occur in Cassim, Hassa, Bisha, Medina and Najaran areas and the dates of these areas are of excellent quality.

Most of the dates grown in other areas are either of poor quality and could not reach the market or many of the date trees are succumbed to wither away due to intense heat and lack of water. Such trees form the raw materials for the manufacture and production of 'particleboards' which are in high demands in the country.

The research study has produced good results on the production of particleboards on a laboratory scale using local, unutilized date palm bio-mass, the model of which can be transferred onto a large scale manufacturing industry to meet the public demand.

### Previous Works

Historical perspective of the evolution of particleboards as commercial products have been reviewed from the past references. Background information relating to *basic mechanical properties and physical characteristics* of commercial particleboards

are discussed especially with reference to pertinent standards. References are also cited from authoritative references concerning the utilization of diverse agricultural fibres and plant residues in particleboard manufacture.

Literatures on adhesives for wood, in which several major physico-chemical factors influencing the phenomena of adhesion and cohesion are reviewed.

### **Methods of Study**

Laboratory preparation of the furnish from date palm mid ribs, the various units operation involved in the production of both mono-layer and the three-layer particleboards, the mechanical testing and some physical characterization of particleboards produced are studied in detail. The study includes chip production using vibrating cup mill, screening for size classification, blending to impregnate the chips with ureaformaldehyde glue, mat forming and hot-pressing to consolidate the impregnated chips into a chipboard of the desired strength, thickness and density. Mechanical tests consist of three-point bending tests and tensile testing perpendicular to parallel faces. In addition, density determination, water absorption and thickness swelling tests are carried out.

The experimental results obtained from these particleboard specimens are interpreted in terms of interdisciplinary principles of wood science, polymer science and material science. The mechanical properties exhibited by these specimens are compared with those of the commercial particleboards produced in modern industrial plants.

### **Discussions**

Adhesives for wood which covers several major physico-chemical factors influencing the phenomena of adhesion and cohesion are discussed in the research. The

effect of temperature, concentration and degree of polymerization on adhesion, the influence of pH on the hardening of glue, and the rheology of glue are among some of the important factors discussed, with special attention given to the hardening of glue.

Utilization of synthetic glues of various kinds in wood processing and associated industries has increased tremendously in recent decades. Ureaformaldehyde (UF) resin is by far the most extensively used adhesive in the particleboard and plywood industries. The chemistry, manufacture and polymerization of UF and the more expensive but less utilized melamine-formaldehyde (MF), and phenol-formaldehyde (PF) are explained in detail in the research report while their relative merits and demerits are highlighted. The prospect of using isocyanate binder as a substitute for ureaformaldehyde in chipboard production is a relatively recent development prompted by new environmental concerns to minimize free ureaformaldehyde emissions from finished particleboards. Hence, for their increasing relevance in the particleboard industry, the pertinent features of isocyanates have been reported in some detail in the research.

### **Conclusion and Recommendation**

Particleboards produced from date palm mid-ribs and subjected to standard tests yielded excellent results. The mechanical properties achieved through optimization of thermo-mechanical parameters are shown to satisfy the requirements of international standards and exceed those of commercially control particleboards produced from other varieties of ligno-cellulosic materials.

Base on the availability of prune date palm biomass which exceeds more than 500,000 metric tons per annum in the Kingdom of Saudi Arabia, it is recommended to make further economic feasibility study for setting up a particleboard manufacturing plant to meet the domestic need for this material.

## صناعة ألواح الخشب المضغوط من مخلفات أشجار النخيل المحلية

طالب يونس ألب و فيصل إبراهيم إسكندراني  
كلية الهندسة - جامعة الملك عبد العزيز

المستخلص : هذا البحث يوضح النتائج التي تم التحصل عليها خلال سنتين من العمل بهدف صناعة المنتج المسمى بالخشب المضغوط على مستوى عينات مخبرية باستخدام جريد النخيل المتوفر محليا بالمملكة العربية السعودية.

إن النتائج المعملية التي تم التوصل إليها بعوامل مختلفة أظهرت صفات ممتازة لتماسك الحبيبات بتأثير الحرارة والضغط والتركيز ووقت البلمرة على الالتصاق والخواص الميكانيكية التي تم الحصول عليها من الدراسة المتكاملة للحدود الحرارية وميكانيكية، وتبرز المواصفات الدولية للخشب والتي تعتبر أفضل من الخشب الحبيبي التجاري المصنوع من أنواع أخرى من المواد السليولوزية.

أظهرت الدراسة أن الكميات الكبيرة التي يتم إحراقها من جريد النخل والتي تزيد عن ٥٠٠,٠٠٠ طن متري كل عام في المملكة العربية السعودية أمكن استخدامها لصناعة الخشب المضغوط ذو نوعية ممتازة، وتحتاج الكميات الضخمة والنوعية الممتازة لجريد النخل إلى دراسة جدوى اقتصادية لإنشاء مصانع للخشب الحبيبي لسد الاحتياج المحلي من هذه المواد.