WOOD BASED PANEL RECYCLING AFTER RAW MATERIAL RECOVERY FROM OLD WOODEN CONSTRUCTIONS

ARISTOTLE UNIVERSITY OF THESSALONIKI, GREECE
FACULTY OF FORESTRY AND NATURAL ENVIRONMENT

Charalampos Lykidis
Lecturer (407)
e-mail: bablyk@for.auth.gr
Telephone: +30 2310 992322,
FAX: 2310 998947

Athanasios Grigoriou
Professor
e-mail: agrigori@for.auth.gr
Telephone: +30 2310 992741, 998893
FAX: 2310 998947

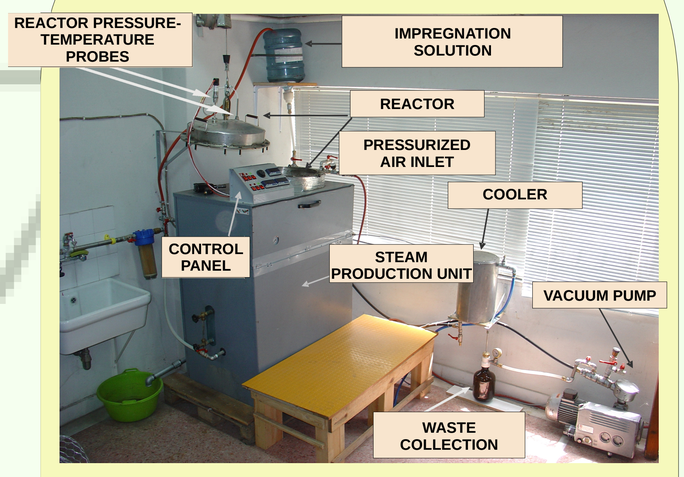
FOREST PRODUCTS LABORATORY

http://wbp-recycling.web.auth.gr

FURNITURE

WASTE

WOOD BASED PANELS



SMALL SCALE UNIT FOR THE RECOVERY OF WOOD BASED PANEL RAW MATERIALS

HYDROTHERMAL TREATMENT

RAW MATERIAL RECOVERY

INTRODUCTION

The particleboard and fibreboard waste constitutes in our days an important part of urban waste stream because they are used in increasing amounts for the production of interior wood constructions. The management of such waste already troubles the modern societies. Nevertheless, via recycling it is possible this waste material to constitute a valuable resource for the production of new wood based panels thus helping on one part in the partial fulfillment of increased needs for wood and on the other part in the restriction of problems caused by these materials when they are landfilled.

AIM

The aim of the present research project was to study the possibility of applying hydrothermal treatments for the recovery of raw materials used in the production of particleboards and medium density fibreboards (MDF) and their reuse in the production of new (recycled) boards.

RESEARCH METHODS

The research was carried out in 3 phases, the first two of which aimed at finding out the optimal conditions for recovery of wood particles from industrial particleboards. In particular, the 1st phase of research was carried out in order to roughly estimate the efficiency of various recovery conditions using as criterion the quality of the recovered material. From the 1st phase 7 groups of recovery conditions arised, which were applied in the 2nd phase. In this phase, recycled particleboards were produced from the recovered materials and their properties were evaluated. The optimal recovery conditions, that finally resulted, included particleboard impregnation with water (45% retention) and 10min hydrothermal treatment with saturated steam at a temperature of 150°C. These conditions were applied in the 3rd phase of research for the recovery of raw materials from particleboards and fibreboards derived from old wooden constructions and their utilization in the production of new (recycled) particleboards. Particularly, wood particles and coverings (plastic coverings and veneers) from old particleboards as well as fibres from old medium density fibreboards were recovered. Using the above materials in various combinations with fresh wood particles, 13 different types of particleboards were produced. The properties of the produced boards were determined in order to study the effect that the participation of recovered material (with and without the recovered coverings) has on the quality of the boards. Also studied was the effect of the participation of recovered fibres, when used in the surface layers in mixture with recovered particles, on the quality of the boards. Finally, also studied was the effect of recycling on the quality of particleboards made on one hand of 100% fresh wood particles and on the other hand of 100% recovered material from old particleboards.

RESULTS

The results of the 3rd research phase show that the wood particle recovery with hydrothermal treatments caused a reduction of their acidity and formaldehyde emission, an increase of the total extract content and more specifically an increase of ethanol-toluene solubility, while it does not appear to considerably influence the ash content. Regarding the chemical structural components of wood, the hydrothermal treatments caused a reduction of holocellulose and minor alteration of lignin content.

In regard to the board properties, the participation of old particleboard recovered material (including in the core layer the crushed recovered coverings) up to 35% do not have substantial influence on the main properties of the boards. Similarly, percentages of old particleboard recovered material (after removing the recovered coverings) up to 50% do not negatively influence the quality of the particleboards.

By increasing the participation amounts of old particleboard recovered material in particleboards (manufactured by fresh material), a considerable decrease of board formaldehyde content occurred. Repeated recycling procedure caused a further reduction of boards formaldehyde content.

Moreover, 2nd recycling of boards made by 100% fresh material, as well as the recycled boards made with 100% recovered material from old particleboards, presented (with the exception of the modulus of elasticity in bending) considerably downgraded quality compared to the properties of initial boards.

In addition, the replacement of hydrothermally recovered wood particles in the surface layers by recovered fibres in a proportion of 10 and 15% does not cause important change in mechanical but considerably downgrades the hygroscopic properties of the particleboards.

Regarding colour changes, the replacement of fresh wood particles by old particleboard recovered material in rates up to 50% did not cause colour differences perceptible by the human eye. Finally, concerning the waste generated during the applied recovery process it was found out that it contains high concentration of ammonium ions which seems to exceed the current marginal values for tap water in Greece. The values of the other ions detected in the waste (Cl^-, NO_3^-, SO_4^{2-}, Na^+, K^+, Mg^{2+}, Ca^{2+}) did not exceed the marginal values of related Greek standards.

3rd COMMUNITY SUPPORT FRAMEWORK OPERATIONAL PROGRAMME
COMPETITIVENESS
EUROPEAN UNION HELLENIC REPUBLIC

This research project (03ED928) was implemented within the framework of the "Reinforcement Programme of Human Research Manpower" (PENED) and co-financed by National and Community Funds (25% from the Greek Ministry of Development-General Secretariat of Research and Technology and 75% from E.U.-European Social Fund)
Project duration: 2005-2009

PROJECT PARTNER:
ASSOCIATION OF LOCAL AUTHORITIES OF GREATER THESSALONIKI