

## Pulped Furniture

### The reapplication of an old technology with an echo-material

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#### Abstract

The World Commission on Environment and Development (1987) defines sustainability as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. And according to the International Institute for Environment and Development (IIED) 1996, the average worldwide annual paper consumption is 48 KG per person.

Regarding that process of recycling paper, that is counted as one of the best methods to save nature. It seems that it does not reflect the right mean of the definition of sustainability. Because of operations such paper bleaching, or pigments removing with chlorine gas or Dioxin, Those elements which cause environmental pollution, and go within human food chain to affect all the eco-system.

Here emerges the importance for pulp paper technology as perfect solution for this problem. That is because the amount of used water within the process of recycling paper with pulp technology is fewer than the process of recycling paper regular ways. Plus using no chemicals such as chlorine gas or Dioxin, which really save nature from extensive hazards. Based on such information, there is a crucial need for designer`s creativity to apply pulped paper technology in various type of products. Mentioning the new compositions of paper with glass, polymers ...etc, that could start a new generation of products attract consumers, and overcome the negative image of green products, with functional, esthetical features.

#### Keywords

Pulped Furniture, Echo-Material, recycled paper, sustainability, functionality.

#### 1. Introduction

Man wonders when he thinks of the hundreds of times a day we touch (paper -- newspapers, cereal boxes, toilet paper, water bottle labels, parking tickets, streams of catalogs and junk mail, money, tissues, books, shopping bags, receipts, napkins, printer and copier paper at home and work, magazines, to-go food packaging). This list could fill a paperback. The average worldwide annual paper consumption is 48 KG per person (International Institute for Environment and Development (IIED) 1996). And there is some more information that must be introduced first to show the importance of finding a practical application for recycled

paper:

- Recycling 54 KG of newspaper will save one tree.
  - Source: Government of Canada, Digital Collections
- Paper manufacturing is the 3rd largest user of fossil fuels worldwide.
  - Source: American Forest and Paper Association, (Garner, J.W. - Energy Conservation Practices Offer Environmental and Cost Benefits. Pulp & Paper, October 2002).
- Paper manufacturing is the largest industrial user of water per pound of finished product.
  - Source: American Forest and Paper

#### Association

- Recycling paper uses 60% less energy than manufacturing virgin timber paper.
  - Source: "1996 Statistics, Data Through 1995." American Forest and Paper Association. November 1996. Pg. 2
- Recycling one ton of paper saves 682.5 gallons of oil, 7,000 gallons of water, 3.3 cubic yards of landfill space.
  - Source: Waste Reduction is a Smart Business Decision, Onondaga Resource Recovery Agency, 1998
- Dioxin is one by-product from use of elemental chlorine gas in paper bleaching.
  - Source: Printers National Environmental Assistance Centre, Fact Sheet by Todd MacFadden, June, 1996

Paper made of recycled materials has been produced in the United States since 1690 by William Rittenhouse, Pennsylvania. This method of papermaking came from China, where it had been used since 1905.

(<http://www.pulpanpaper.org/history.shtml>)

In 1031, Japan pioneered paper recycling when it began using waste paper to make new paper. All Japanese paper was re-pulped and made into new product for sale in paper stores.

In England in the early 1800s, mill owner Matthias Koops patented a process that removed ink from paper before it was recycled. This is now a common practice known as deinking. Koops also experimented with making paper from different fibers, including straw. His research led to the later use of wood pulp in papermaking.

(<http://www.pulpanpaper.org/history.shtml>)

In 1895, Col. George Waring instituted the first comprehensive municipal waste management system, declaring that various different forms of trash (ashes, organic refuse, and paper) must be deposited in different bins for collection by the city. Some of the reusable waste was also resold.

(<http://www.pulpanpaper.org/history.shtml>)

Pulp is commonly known as a lignocellulosic fibrous material prepared by chemically or mechanically separating cellulose fibers from wood, fiber crops or waste paper. Pulp is one of the most abundant raw materials worldwide. It is most commonly used as raw material in papermaking, but recently with the ecological awareness, there a trend to use waste paper with higher percentage to recycle and produce simple products within what is known as green design

which is as an approach emerged as a response to the devastating impacts of human activity and aims at eliminating the depletion of natural resources, reducing the environmental impacts and protecting ecosystems. In addition to protecting environment green design promotes social equity and economic growth (Walker S. 2006) - it is based on the three cornerstones ecology, equity and economy (Ljungberg LY. 2007).

These products used to be rough and not that attractive for the regular consumers, so designers aimed to apply it into (cheap, secondary, one time use... etc.) products. Because of negative image about the weakness of such green products, however recently consumers have become more aware of environmental problems. But still, there seems to be little interest in changing buying behavior (Walker S. 2006, Stevels A. 2000). In fact there is a lack of accordance between consumers` opinions and actions (Krozer Y. 2004, Stevels A. 2000).

So the question of this paper is: could pulped furniture be an effective solution for both the weak relation between consumer and green products, and environmental pollution caused by paper products waste? The answer will be through exploring previous individual designs, That may open new fields in front of designers to create new generation of green designs meet the consumer`s expectations.

## 2. Echo-Materials Definition

Eco-materials are defined as those materials that enhance the environmental improvement throughout the whole life cycle, while maintaining accountable performance (Halada and Yamamoto 2001). Eco-materials play a key role in material science and technology to minimize environmental impacts, enhance the recyclability of materials, and to increase energy and material efficiency.

In North America and Europe, eco-materials are often called "environmentally-friendly materials" or "environmentally preferable materials" according to different interpretations, for example:

- Eco-materials are those that can contribute to reduction of environmental burden through their life cycle (Shinohara, 2004).
- Environmental preferable products – those having a lesser or reduce effect on human and the environment when compared with competing products that serve the same

purpose (USEPA). In other words, any material could be an eco-material as long as it satisfies pre-requisites and necessary conditions of eco-materials include

the optimization of physical and/or chemical properties and best technical performance (as shown in Fig.1).

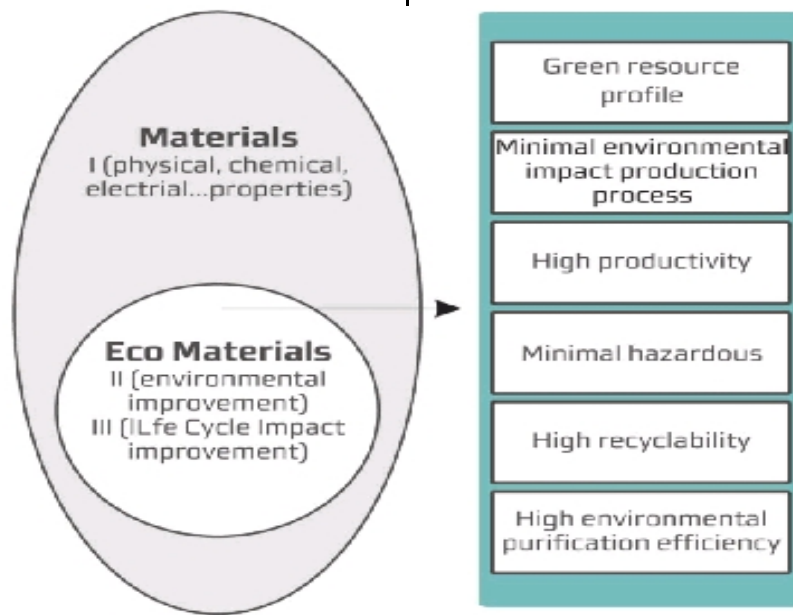


Figure 1 conceptual model of eco-materials within the context of material science

### 2.1 Eco-Materials Classification

There some tries to classify eco-materials from the view point of life cycle concept. New development of materials or eco-materials should be viewed in the full context of sustainability. This classification method of eco-materials was based on the four sustainable principles:

- “cyclic” materials
- Materials for ecology and environmental protection
- Materials for society and human health
- Materials for energy based on the two main criteria as their sources functions.

These four main categories were then classified further to ten sub-categories (fig.2). And some

materials could be classified into several sub-categories, up to the features it provides within the application it used in it. For example, (table 1) waste paper could be classified according to (Nguyen X. H., Wang Y., and Yamamoto) model into:

Table 1- Examples of waste paper categories as an eco-material currently commercialized in Japan

Sub-categories	Examples
<b>1A: recycled materials</b>	Eco-cement, glass ceramic from wastes
<b>1B: renewable materials</b>	Wood ceramics, wood based materials
<b>3B: materials for reducing human health impacts</b>	Sound proof panels

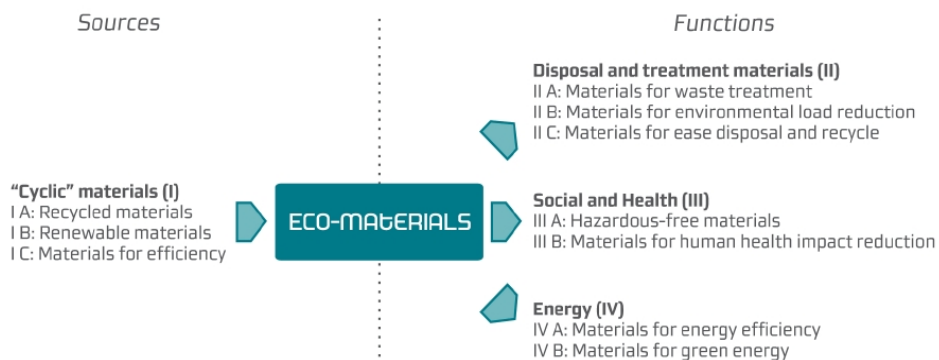


Fig. 2 (Nguyen X. H., Wang Y., and Yamamoto) Classification model for eco-materials

### 3. Pulping Technology

Molding is the process of manufacturing by shaping pliable raw material using a rigid frame or model called a pattern. A mould is a hollowed-out block that is filled with a liquid like plastic, glass, metal, ceramic or paper raw materials. The liquid hardens or sets inside the mold, adopting its shape. A mold is the counterpart to a cast. Typical uses for molded process include molded furniture, molded household goods, molded cases, and structural materials.

Molded pulp, and the manufacturing process associated with molded pulp, is perhaps most readily identified with egg packaging and fast-food drink trays. Because pulp can be molded into complex 3-dimensional shapes with the ability to effectively enclose and protect all types of products. An understanding of recycled paper fibers and the ability to apply that knowledge to the manufacturing process requires special skill, and is in many ways more art than science.

Molded pulp products can be made from a variety of fibers depending on the desired aesthetic, function and material life-cycle. Creative designs made from molded pulp with embossing and after-pressing it possible add extra design elements to make the desired appearance.

Molded pulp is the result of combining water and recycled paper – including newsprint, corrugated and other select paper grades – in a vat resembling a large blender to create slurry of proper consistency. Custom designed tools, which are attached to a molding machine, are submerged into this slurry. Pulp is then drawn onto the screen mold via a vacuum process; paper fibers accumulate to a desired thickness and strength while excess water is removed. When the vacuum process is complete, the

fibrous formed part is transferred to an oven whereby it is carefully dried, packed and prepared for shipment.

The pulp industry may at first glance seem like a mature business where innovations are not so frequent any more. Nothing could be farther from the truth. To a large extent, the economy of tomorrow is based on what our wastes thing can give us.

#### 3.1 Pulping Technology as an echo-solution

Moulded pulp or molded fiber, is a packaging material, typically made from recycled paperboard and/or newsprint. It is used for protective packaging or for food service trays and beverage carriers. Other typical uses are end caps, trays, plates, bowls and clamshell containers.

For many applications, molded pulp is less expensive economically and environmentally than expanded polystyrene (EPS), vacuumed formed PET and PVC, corrugation, and foams.

Molded pulp is often considered a sustainable packaging material, as defined by the Sustainable Packaging Coalition, since it is produced from recycled materials, and can be recycled again after its useful life-cycle.

The regular process of paper recycling involves mixing used paper with water to break it down. It is then chopped up and heated, which breaks it down further into strands of cellulose, a type of organic plant material; this resulting mixture is called pulp, or slurry. It is strained through screens, which remove any glue or plastic that may still be in the mixture then cleaned, de-inked, bleached by Dioxin and chlorine gas, then dried to produce white paper sheet. Here is where the environmental problem, because of the waste water of such process, the water supplies polluted.



Picture 1 - A simple chair made of pulp paper inspired by the design of egg packaging paper.



On the other side, if the process stopped at pulp paper stage, there is not enough application to get used into it. So the modern starting though to use pulp into furniture and simple products, in new mixers opens brand new fields to use such material and save environment.

#### 4. Pulped Furniture in Actual Life

For the pulp industry, it's necessary to think outside of the box as wood is much more than a basic material for furniture production. The challenge facing new materials is often that no one really wants or dares to buy something completely new. There have been numerous studies and researches about recycling or reusing the goods. However, one of the most fundamental ways is to make furniture with

fewer amounts of wood. 'Pulp Furniture' adapts the same process used to create protective pulp packaging to fashion stylish and modern furniture. Pulp Furniture takes its inspiration from the structural integrity and recycled quality of recycled paper packaging.

The main body of Pulp Furniture is produced by pressing the recycled pulp. Then, the skin is covered by any materials so that it renders the impression that the furniture is made of the wood from the scratch. The thick pulp has the right intensity for carpenters to work on, and with special treatment it can be protected from water. Pulp Furniture can also be reborn by changing the main body and get a new function.



Picture 2 - By using a molding technique has become a new form of furniture design



Picture 3 - Modern Paper Pulp Furniture Looks like Giant Egg Cartons. It Explains the features that Lightweight, transportable, biodegradable, recyclable and just plain awesome

#### 4.1 Advantages of Pulped Furniture

Inspired by the pulp spacers used in packaging, the Pulp furniture is designed. Even though this furniture is made out of paper, they are sturdy enough to carry weights. Despite a paper construction, the structural design has been carefully calculated to be sturdy enough to withstand considerable human weight and

stress. Apparently, the pulp furniture looks stylish enough to be on any modern homes. If made out of recycled paper, through the pulp furniture, landfills will definitely be minimized drastically and used papers will be given a new life instead of having them landed into our landfills.

It is often cheaper to buy up front because it is made from a relatively inexpensive, and often

recycled, material. Shipping is usually less expensive also because it can be packed in small sizes and it does not weigh as much as traditional furniture. Pulp furniture can also be safer than traditional furniture; it is softer and doesn't have sharp edges.

In addition, when traditional furniture becomes outdated or worn out, if it cannot be resold. Often, it must be thrown into a landfill. However, this furniture is more environmentally friendly because when it has served its purpose, it can be recycled along with normal boxes or containers. It is less expensive than traditional furniture, can be easily disassembled for storage and transportation and is more environmentally friendly because it can be recycled after it is no longer wanted.

It has a flexible property such as the seats that following in the footsteps of other accordion-inspired designs like the newspaper and paper Soft seating, Flexible takes the concept a little bit further by being able to function as both a single chair and an extended bench. It made from widely-available, low-cost recycled materials (paper and wood), also produced using pre-existing manufacturing processes.

### 5. New Design with pulp Method inspired furniture designer

Currently molded pulp is being used as a green statement. Designers are realizing the protective benefits of molded pulp furniture and consumers are aware of the sustainable aspects of the material. Designers must think outside the box with the new material for improve its properties and pleasing to the taste of the client and achieve Popularity in the markets. The technology that affords us to organic shape, form, morph, undulate, twist, torque, material and behavior are definitely a movement. Here are some examples of designs can be inspired Molded Pulp furniture:

Furniture Designer Amanda Levette designs, the bench is both sculptural and practical, and the bench is highly moulded and seats people comfortably. It reflects the fluidity and seamlessness of the design. With Molded furniture there's just no need for the functional to be boring –the design flexibility proves it, through the possibility of work with curves, great stability and strength, several of colors and finishes to suit our ambition in the internal spaces.



Picture 5 – A bench designed by Amanda Levette.



Picture 6 - A variety of designs for seats molded in different shapes and colors reflect the spirit of contemporary and suitable for all internal spaces. The decisive and rigorous lines of the chairs contrast with the dynamism of its profile, a sense of movement which is accentuated by the union of curved and straight lines

Potential method of pulp can be managed to combine aesthetics with innovative design and engineering, creating a product of great quality and aesthetic impact. It can be covered with any fabrics or leather and mixed with several of material and held in place by a powder-coated steel band. It also could be reinforced with ultra structure to be like a skeleton. This brings this material with an increased sense of sophistication through its form, finish and combination with other materials.

## 6. Discussion

Pulp furniture is a new term in the field of design, could open an enormous chance for developing economics in several countries. Plus the environmental benefits, those reflect in saving the green area, power and avoid polluting the local environment. So is the contribution in developing consumer behavior towards eco-materials products.

Egypt for example, represent one of the countries suffers environmental pollution. One of the reasons is paper and its raw material that come out the agricultural waste, regular paper waste. Interstate Paper Industries works with the Egyptian community by purchasing and recycling waste paper from the local market in Cairo and Upper Egypt. In 2011, the mill projects purchased 24,000 tons of waste. And this did not use the available quantity in the land fields around the country. Redirecting the industry toward pulp paper with new opportunities, new markets through new products that just started to grow up, could lead to a breakthrough economically and environmentally.

## 7. Conclusion:

The research ends with that designers could increase their inspiration by using eco-materials with all the features and possibilities it provides. Paper industries working with the Egyptian community and other developing countries should encourage designers to apply eco-materials in new products as a promising sustainable economic industry. It seems feasible that academic institutions need to pay attention to studies on ancient techniques and to utilize them into usable products satisfying consumer taste and save the environment at the same time.

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