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Molded Pulp Packaging and Machinery Innovations

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In the packaging industry today, there is a big push for sustainable packaging. Most people are in agreement that greenhouse gases are affecting the environment in a negative way, and every company wants to appear more green or eco-conscious with their packaging. With the emphasis on sustainability at major companies like Wal-Mart, many manufacturers are taking a close look at how their materials are made and the energy needs they create. Besides being 'green' in the environmental sense, many companies are realizing that the changes they are making are 'green' in the economic sense, with cost savings and environmentally conscious consumers looking for these products. As companies are being pushed to create more sustainable packaging, in turn, they are pushing machinery manufacturers to create machinery that is more sustainable, efficient, and can use sustainable or recycled materials to create packages.

One of the first machines to exploit its sustainable technologies is the PAKIT 100™. This machine was designed with efficiency and sustainability in mind. PAKIT Technologies has a comprehensive website (PAKIT) that provides information on their machinery and processes. The company believes it has a real advantage over machinery that makes the typical thermoformed pulp packaging due to of several new innovations. PAKIT technology says, 'The PAKIT 100 is

designed for high-volume production of a high value packaging medium using less energy, labor and natural resources than alternative fiber molding techniques. (PAKIT)' Technological advances such as a closed loop water system and microwave drying are also key sustainability features.

Molded pulp packaging is not new technology. It is assumed that artisans in early Oriental, Egyptian, and Greco-Roman civilizations experimented with screen felting of vegetable fibers into sheets of paper. These artisans quickly learned to emboss the screening material to create contours (Brody & Marsh, 1997). It is even believed that wall and ceiling molding artifacts from these civilizations were created like this (Brody & Marsh, 1997).

The Wiley Encyclopedia of Packaging Technology defines molded pulp as, "three-dimensional packaging and food-service articles that are manufactured by forming from an aqueous slurry of cellulosic fibers into discrete products on screened, formaminated molds in a process analogous to continuous-sheet cylinder-board paper making (Brody & Marsh, 1997)." Molded pulp packaging has been used as dunnage since World War I.

Figure 1: EPS Trays Compared to Nested PAKIT 100 Products (PAKIT)

Today, molded pulp packaging has become the sustainable alternative to expanded polystyrene (EPS) packaging. Molded pulp serves as a protective packaging material used to transport fragile foods like eggs. The recycling process for molded pulp packaging is fairly straightforward and new molded pulp products can be easily made of recycled materials. In addition, molded pulp can be less expensive than expanded polystyrene. Expanded polystyrene packaging is petroleum based and with recent concerns about availability and sustainability of oil, many companies have begun looking for alternatives.

Molded pulp is not only considered more environmentally friendly, but recent tests conducted by independent university researchers have revealed that molded pulp reduces G forces more effectively than expanded polystyrene and dampens vibrations three times more effectively (“The search for sustainability: Paper”, 2007.) Other benefits of molded pulp include the capability to nest, no static

electricity concerns, environmental and marketing advantages, and fewer international restrictions.

Recently, one of the largest independent produce wholesalers in the United States, Four seasons Produce Inc., began using molded trays made of palm fiber for its produce packaging. The company decided to launch this new packaging on earth day to draw even more attention to the company's environmental efforts. The company chose to use trays from Earthcycle Packaging for the company's organic produce. The trays made of palm fiber are said to compost in less than 90 days. These trays are more expensive than what the company was previously using, but they are expecting to make up the difference by expanding distribution (Lingle, 2007).

Palm fiber was once considered a waste product that would, typically, be landfilled or incinerated. With new technology, this waste material is being made into food grade packaging that can be biodegraded through commercial or municipal composting. Palm fiber reduces the impact on landfills and incineration, and is made from a renewable agricultural biomass. It is extremely easy to grow and clearly sustainable.

Palm fiber, along with many other materials that can be used for molded pulp packaging, has been certified by the Biodegradable

Products Institute (BPI) as safe for commercial or municipal composting. The Biodegradable Products Institute (BPI) has created a list of many materials that currently pass the ASTM D6400 and ASTM D6868 testing requirements for biodegradability. These materials are certified with a label that can be placed on the packaging to tell the consumer that the packaging is safe to compost at either commercial or municipal facilities.

There are two very basic methods used in creating molded pulp packaging: plain molding and precision-molding. Plain molding refers to more rugged applications like corner posts used in transport or egg cartons that have been hotpressed and graphics applied. These are usually produced on highly automated and productive machinery.

Precision molding is different because of the way the molded pulp is dried. Water is removed by compaction and heat. This creates a smoother, usually denser, more contoured and more precisely dimensioned product than plain molding. The PAKIT 100 would fit into the precision molding category however it is a highly automated process.

The process starts with the pulping of a cellulose fiber material (virgin or recycled). Suitable and potentially available raw materials that could be used are: bagasse, wood pulp, hemp, kenaf, and palm.

This wide selection could allow the customer to utilize locally available materials with less transportation cost and by minimizing the energy used to bring the material to the point of processing, while supporting a local economy.

These alternative materials are becoming more popular than traditional wood based sources. The quick growing times for many of these non-wood cellulose fiber materials makes them a very sustainable choice. Many of these materials are certified by the Biodegradable Products Institute.

After pulping, the material is mixed with chemicals or additives specific to the end user. The mix then moves on to the 'forming unit', which is a servomotor driven piece of machinery that uses PAKIT's proprietary sintered tooling. The fibers are deposited onto the sintered forming tools with the use of a vacuum to pull the fiber mix evenly over the mold. Traditionally, the slurry is pumped into a mold which forms the shape with heat and a screen on one side of the mold. The screen is used to draw out the excess water with a vacuum. The tools used in the PAKIT 100 are closely matched male and female dies that are smooth. These dies create a smooth

Figure 2: Printability of PAKIT Products

finish on both sides of the formed product because there is no use of a screen.

The forming process is a three-stage process, beginning with the pulp being heated and pressed three times. Heating and pressing helps to begin to dry the product by reducing water levels down to about 30%. Since product drying is initiated during the forming process, production rates can increase and prevent some problems such as micro cracking, strength loss and warping. These quality problems can be caused during drying for various reasons such as attempting to dry to fast, over drying, or uneven drying.

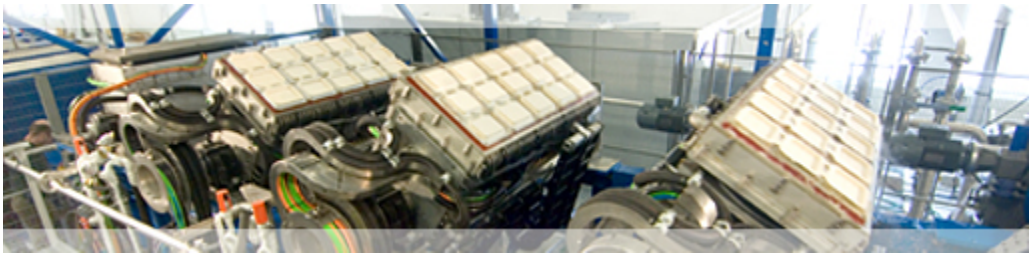

Figure 3: PAKIT 100 Three-Stage Process (PAKIT)

The three-stage heating and pressing process increases the fiber density, smoothes the product surfaces, and creates tension in the fiber network, thereby creating a stronger and stiffer product. Since the forming process creates a stronger product, the walls of the molded products can be thinner than conventional molded pulp packaging with a lower risk of deformation or cracking during

production or shipping. This technology allows users to create products with complicated shapes such as, “compartmental plates, clamshells and trays for the food industry, protective packaging for the electronics and pharmaceutical industries. (PAKIT) ”

Once the molded fiber product has exited the forming unit, it is sent to the drying unit. The compact drying unit on the PAKIT 100 is a specially designed microwave dryer. This machine was the first machine to successfully use a microwave dryer. The microwave dryer helps concentrate the energy where drying is required, and used to dry the molded pieces to the desired moisture level. Due to the fact that the PAKIT 100 machine utilizes only electric energy, a variety of renewable energy sources are available for the electric energy.

The dried molded pieces can enter one of several post-treatment processes such as lamination, printing, trimming, punching, stacking, bagging, and/or coating. These treatments are based on specific end-user needs. Many of these post-treatment processes can increase the value and potential markets for molded pulp products. Some manufacturers have laminated a thin thermoplastic film to one surface of the molded fiber product by a vacuum-thermoforming process. This creates a package that can be used for frozen meals and considered “dual oven-able”. Molded pulp trays laminated with PET can withstand

oven temperatures of 400 degrees F (Brody & Marsh, 1997). This allows freedom as the product can be taken directly from the freezer and put into the microwave or oven.

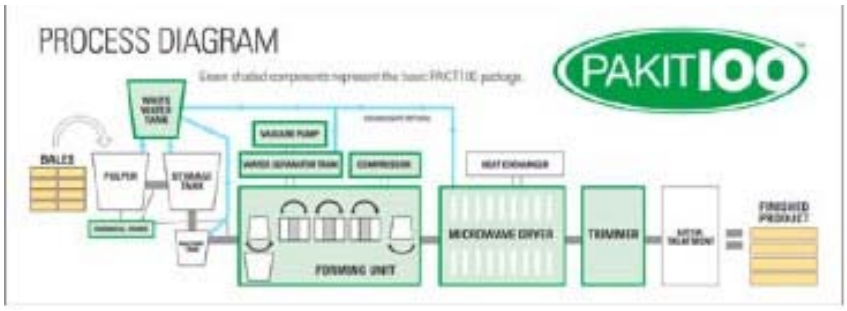

Figure 4: PAKIT 100 Process Flow Diagram (PAKIT)

The active platen area on the PAKIT 100 is 49.6 inches by 22 inches (1260 mm x 560 mm) allowing it to produce a wide range of product sizes. The drop rate is about 5-7.5 drops per minute or 350 – 450 drops per hour. Although slower than other molded pulp manufacturers, the process is faster than other thermoformed processes. Currently, the maximum product height is just 3.94 inches (100 mm) with a draw angle of 12 degrees for most products, which could limit some applications. The draw angle would have a possibility of being less depending on the height of the product.

The proprietary sintered tooling that is such a critical component on the PAKIT 100 machine is designed for fast change over. The machine parts and dies are easily changeable and are cheaper than

conventional tooling according to PAKIT. PAKIT has a full-scale tooling center that uses advanced milling equipment allowing for new tooling to be made quickly and economically. A new mold can be processed in four weeks and a replacement mold can be processed in as little as two weeks.

An additional feature of the PAKIT 100 machine is that all water from the forming unit and steam from the microwave dryer is recovered. This “closed-loop” machine design for water recycling is unique and innovative for the PAKIT machine. The ability to recycle and reuse water in this machine makes the machine environmentally friendly while providing substantial cost savings. An additional labor cost can also be saved due to the fact that up to three PAKIT machines can be run by just two operators, unlike other competitors.

Molded fiber packaging from the PAKIT machine can be used as an alternative to petroleum-based plastics. Molded pulp materials can be biodegradable, compostable or fully recyclable depending on the additives included in the formulations. The smoother surface of the PAKIT produced molded pulp products is printable, moisture resistant, freezer, microwave, and oven safe (up to 300 degrees F). These smooth surfaced products are also created to nest tightly, unlike PS products, therefore lowering transportation costs by putting more

containers per case and per truckload. These higher shipping densities also lower the environmental impact of the transporting, be reducing greenhouse gas emissions.

In certain applications, lower quality cellulose fiber materials might be able to be utilized without compromising the integrity of the end product. This feature allows manufacturers to easily alternate between recycled, virgin or other fiber sources for the production of their packaging components.

The PAKIT 100 was also designed to run quieter than current molded pulp machines thereby creating a more pleasant work environment for employees. The compact footprint of the machine allows converters to intentionally locate plants close to customer markets thereby decreasing warehousing, transportation and the overall environmental footprint of the package. The PAKIT 100 is an excellent example of a machinery manufacturer creating an efficient machine that is more sustainable than predecessors while creating a sustainable package.

Sustainable packaging technology is constantly growing and will continue to grow as retailers and consumers begin to expect more out of the packaging they purchase. Molded pulp, and other easily renewable, recyclable, and moldable fibers, are great alternatives for

many packaging applications. The ability or option to compost packaging may not be prevalent in all parts of the United States, but in many parts of the world it is. Just as recycling facilities at one time were not prevalent, the need and ability to recycle materials influence change. As packaging consumers become more knowledgeable of the ease of commercial composting and its environmental benefits, coupled with an increasing number of compostable packaging materials the demand for molded pulp packaging will change. Consumers will begin to realize that the packaging choices they make today effect the future generations, and they will continue to look to the packaging industry to provide them more sustainable packaging options. Machinery technology, like the PAKIT 100, is one example of such an option.

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