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 forests can give us and where pulp (or fibers) is a major component.

“For the forest industry, it’s necessary to think outside of the box as wood is much more than a basic material for furniture production and pulp for paper manufacturing,” says Mikael Lindström, Research Manager for the New Materials and composites group at the Innventia research company and adjunct professor at Konstfack. “One example is the composite materials created by mixing polymers with cellulose fibers. Personally I’ve been involved in the development of a material called Durapulp, which is made out of cellulose fibers and PLA (PolyLactide Acid).”

Durapulp wasn’t known to the general public until designers were invited to demonstrate what could be done using the material.

“In the beginning we only had simple plates to show as examples,” says Lindström. “And those plates weren’t...
that convincing. But when we hired designers who used
the material for something more practical, people began to
appreciate that Durapulp is a material to be reckoned with.”

Innventia (formerly STFI-Packforsk) is a world leader in
research and development relating to pulp, paper, graphic
media, packaging and biorefining. One of Innventia’s areas
of interest is to develop new areas of application for fiber.

BIOREFINING PLANTS

“I’m convinced that the pulp mills of today will develop into
biorefining plants in the future,” Lindström said. “The rea-
son being that you simply can’t waste things any longer; you
have to make use of everything from the tree. We can call it
‘total optimization’.”

Material research consists of two different areas, one of
which is supported by the military, pharmaceutical and
space industries. Here, cost is no issue.

The other area, however, is very cost-conscious. Here,
you have to continuously find cheaper or more effective
solutions, for instance how the pulp industry can retain its
profitability in a world characterized by fierce competition.

In regards to new materials, there very seldom exist any
buyers for the simple reason that the market has not com-
missioned anything.

The challenge facing new materials is often — quite
naturally — that no one really wants or dares to buy some-
thing completely new. ‘What’s wrong with the materials we
have?’ they wonder. This means that new materials have to
outperform old materials in two ways: firstly, the new ones
have to be better, and secondly, they have to be cheaper. A
tall order!

Nowadays the focus is on material identity. Here, “natu-
ral feeling” is as important as physical qualities such as
material strength.

“Of course you have to continue testing the material,”
says Lindström. “But the perceived or tactile qualities must
not be forgotten as regards the development of new
materials.”

NEW MATERIALS AND DESIGN

The project is part of a research cluster comprising a num-
ber of companies striving to developing new fibers for new
materials.

“It’s easily done to forget the design part when develop-
ing new material. You become so elated by the fantastic
properties of the new material that the design work takes
a back seat. This was what happened with Durapulp, until
the designers developed the Parupu chair.”

Responsive Innovations. “A responsive
material reacts to stimuli in different ways ... a
nice example is the soup container developed at
Innventia. It works as follows: You pour soup into
the container, put it into a microwave oven and
when the soup is ready, the container unfolds
and forms a bowl.”

Actually, Durapulp is nothing more than a new pulp
quality — a good example of how fiber can constitute the
basis for new materials.

“Renewability’ is one of the buzzwords of today, so one
could somewhat carelessly say that we mix everything that
is renewable!” Lindström noted. “The method is user-cen-
tered development where the structure defines the proper-
ties.”

In this research cluster, we find, among others, the com-
panies Ragnsells, a leading materials recycler in Sweden,
and Fortum, an energy generation, distribution and sales
company focusing on the Nordic countries, Russia and the
Baltic Rim area.

“For Ragnsells, bio-degradable materials are a boon since they get more money from renewable refuse than ordinary refuse. This also partly holds true for Fortum, since they in most cases don’t have to pay as much CO₂ tax when using new materials.”

PAPER MUSCLES

Another area where paper is used in new ways is within the field of responsive materials.

“A responsive material reacts to stimuli in different ways, often by returning to its original shape, analogous to a muscle going back to its relaxed state. A nice example is the soup container developed by Hjalmar Granberg and Farvash Razavi here at Innventia. It works as follows: You pour soup into the container, put it into a microwave oven and when the soup is ready, the container unfolds and forms a bowl,” Lindström explained.

“Apart from heat, responsive materials can also react to light and magnetic fields to name but two other stimuli sources.

“Also when it comes to packaging, paper plays a major role in the development of new composites, especially since environmental factors and renewability are becoming more important aspects in the development process. Much is to be won if we can reduce the use of aluminum in the packaging industry.”

A PLASTIC BAG — MADE OF PAPER

It may look like a plastic bag, but it is actually a bag created from chitosan and cellulose.

Chitosan is a polymer containing D-glucosamines. Together with cellulose, it’s an excellent material for the manufacturing of “plastic bags.” To make the bag differ from an ordinary plastic bag (plastic’s image is not so good nowadays), it was important for it to have properties that reduced the plastic feel as much as possible.

“The structure of the bag differs from that of a conventional bag,” says Lindström. “Its surface is rougher. Furthermore, it’s drier and thus doesn’t feel as slippery and oily as a plastic bag.”

THE FIBER INDUSTRY OF THE FUTURE

The ice is broken. Fibers are being used in ever more areas.

“The furniture industry is among the pioneers. The Lammhults company uses spruce pulp and re-cycled PET for some of its furniture. IKEA is also at the forefront in regards to the use of renewable materials as different kinds of wood composites in the furniture manufacturing process.”

Extreme volume focus is a thing of the past. On the contrary, the future has various forms of refined special fibers in store.

“The success factors of tomorrow are smaller volumes of special fibers, in addition to flexibility and the ability to cater to the needs of the market,” Lindström pointed out.

Fibers in material mixes create additional properties, and the fiber industry has the potential to establish new and profitable business models. Since the market pays per property, the more properties a given material is endowed with, the more profitable it is.

One exciting future product is plastic from the forest.

“It may sound like a contradiction in terms, but the research in this field is really picking up speed and I think it will not be long before our forests are an important source of plastic,” Lindström said.

Mikael Lindström is Research Manager for the New Materials and composites group at the Innventia research company and adjunct professor at Konstfack (The University College of Arts, Crafts and Design). He can be reached at: mikael.lindstrom@innventia.com

This article was originally published in Rottneros customer magazine Pulp Focus, #24.