

Good morning! (My name is Angela Wiegand). I am a freelance designer, doing furniture and exhibition-design.

*(1. Adresse und einige wenige Produkt-Bildchen Angela Wiegand )*

I set out on what turned out to be an adventure, designing sustainable seating, on my own, without commission.

*(2. Titelbild mit Sofa)*

I am delighted to present this concept and prototype for discussion. There is no Life-Cycle-Assessment (LCA) for this product, simply because I couldn't afford it. All I could do, is to try to collect all the crucial information about the material, the production process, the performance during its use and the waste management.

I got help on my way from Jakob Winter GmbH in Nauheim and the Fraunhofer Institute for Mechanics of Materials in Halle, where the prototype was made.

**(Design)**

I wanted to design a light furniture with a swinging, individual but at the same time self explanatory form, conveying a light-hearted image. It should be lightweight, material-efficient and made from Bio-material.

My intension was to create a piece, that would perform better environmentally, right from the beginning. Recycling is a step towards avoiding trash by prolonging the life of a product. But after its second lifetime we still have to get rid of the material. And in many cases, this is even more difficult, because one product contains a mixture of materials of different nature.

*(3. Photos Maßstabs- Modelle aus Maschendraht mit Gliederpuppe)*

The seat should be a combination of a small sofa, a Recamière and a wing-chair, that offers a variety of seating positions.

The overall impression is of lightness. I think this suits our lifestyle better than heavy furniture that's hard to move.

I also assumed that people would no longer want to buy a sofa for a lifetime. They'd rather change their personal environment more often.

But how would I make it ecological and with a long life and still make it attractive?

This is my proposal:

## (Design concept)

The underlying concept is to make a piece of furniture in three separate parts:

- 1 (first) The very thin and light seating-shell which forms a bench
- 2 (second) the soft part, the upholstery, which is loosely added on to the bench, and can be exchanged easily for an other, like a dress and
- 3 (third) the feet, that hold them both in place for seating.

*(zeigen am Objekt !)*

- Keeping the different parts and materials separate allows for:

### 1. Better transport:

- by reducing the volume since the soft upholstery can be packed inside the shell
- Through its light weight (the shell weighs approximately 5 kg). As we all know light weight products save fuel and reduce CO2 (carbon dioxide) emissions, which becomes increasingly more important.

### 2. Easier use:

I am personally very glad, if I can easily handle the furniture in my home, and change their position, whenever I want.

- Also, people these days seem to move more often. The shell can be easily lifted up by a woman and fits through any door. The upholstery can be folded and fits in a bag, the base can be carried separately.

*(heben vor Ort?)*

### 3. Better Waste disposal management:

The components of the furniture can be disposed of separately. There is no problem like with the disposal of mixed materials. Just open the zipper, take off the upholstery and open the screws...

## Talking about the materials:

I chose hemp fiber reinforced Bio-plastic, PLA for the seating shell as a more ecological material because:

- there is no need for fossil fuels, PLA = Polylactic acid being produced from starch, deriving from corn or wheat or potatoes
- you can use less material-mass, since the shell can be very thin without losing stability,

- hemp is a renewable raw material, that can be grown in Germany,
- It's a natural fiber, that does n't need herbicides, pesticides, or fungicides while growing, and is a good break crop from cereals,
- hemp fibre uses less energy for production than comparable materials like glass fibre or carbon fibre
- The bio-composite has got good mechanic properties and can be processed with conventional tools,
- it's bio-degradable or can be burnt without toxic emissions,
- and as furniture with longer life, there is a positive effect on its CO2 footprint, since it is storing carbon for a longer period of time.

*(4. Photo von der flexiblen Platte, Enden hintereinander verschränkt)*

Now, this is how I came up with the **construction**:

For my design I was looking for a „flexible board“, – which is a contradiction in itself – that could be free formed as a seating shell of very thin but stable material.

A composite of hemp fleece and PLA is appropriate for furniture because it makes a very robust material. It does not splinter. Its temperature is suitable for seating and it's easy to clean.

I liked the simplicity of forming the hemp fleece like a piece of cloth:  
I cut into the material on one side and overlapped the shorter piece behind the longer. This way I created a paperbag-like form, which gives it stability. I gained firmness by form, not by mass.

**(Form and image:)**

*(5. Photo der Schale ohne Polster und Fuß)*

It's a very simple and self-explanatory form, that you could live with for a long time. It may also be sustainable as an image:

It is a kind of a wave – a symbol of movement. You might also think of a flying carpet...

I think, this image is appropriate for our life-style. We're constantly on the move, but at the same time we want to get back to simple ways of living to save ourselves from the ever growing complexity of life. And we do want some fun and relaxation at home to recover from serious challenges in daily life.

**(Production Process)**

For advice on producing I went to Jakob Winter GmbH in Nauheim, who makes boxes for musical instruments and even funeral urns from PLA and hemp fleece. And I learned more about this material: since it's bio-degradable, the urns – for example – break down in a humid earth environment within 5 to 10 years.

By thermoplast compress moulding the natural hempfleece and the polymer material are heated and pressed together. The major cost arises from the making of a mould.

But, once the mould is made, the price per unit goes down with the number produced in a series.

It's a relatively simple process. There are fewer cycles due to the lower temperature while processing.

And there are no toxic emissions while manufacturing.

In Nauheim I was told, that the shape of the seating shell was ok, not too big, without undercuts and could be produced.

According to first rough estimates of Jakob Winter GmbH in 2009, about 3500 g hemp fleece/PLA is needed per piece at a cost of approximately 28 €.

The cost for an epoxy-resin mould would be about 14 000 €, and for a steel-mould about 40 000 €. If a shell using about 1,30 qm – it would weigh about 4 to 5 kg.

The simplicity of the form of the shell allows for an optimised process with few production steps. That saves energy and lowers the price.

### **Prototype:**

Only it wasn't possible to produce a prototype there, since the cost for the mould was out of the range of my designers-budget. But through Mr. Winter, I made contact with the Fraunhofer Institute for Mechanics of Materials in Halle.

There, a method was found for building an affordable full size-model, or prototype.

#### *(6. Photos Lattenmodell 1:1 mit und ohne weiße Schaumstoff- Fläche drauf)*

I made a construction of single slats that was used to define the shape of the shell and brought it with me to Halle.

Material-experiments were made in the Institute and finally this prototype was formed out of hempfleece and epoxy-resin. The curing process of the epoxy-resin runs at a low temperature. This is what makes it less expensive.

A sandwich structure was used, that consists of decking laces made from hemp fleece and a cardboard-core in a sinus geometry. This geometry of the core-material allows a wide range of spherical forms in sandwich constructions.

The seat and the back of the furniture can then be freeformed, the form follows the seating comfort.

#### *(7. Photo von Sitztest mit Person)*

Based on the results of our tests of the seating positions, we had previously altered the form of the slats.

(the dimensions are: 1.20 m in length, and 87 cm in height, the shell being 55cm in depth, 58 cm in height)

#### *(8. Foto von der fertigen Schale)*

A type of a Prepreg was made in Halle. The decking laces were first impregnated with the epoxy-resin, became compacted in a vacuum bag and were finally cured at

room temperature.

Through this low-tech process, we were able to build the right form of the seat. The laces and the cardboard-core being strong enough to build the spherical form.

#### *(9. Photo des fertigen Prototyps mit Fuß)*

So far the prototype has been used to simulate the final serial hotmelt production process. Using hemp fleece, we were able to test how it would work in a similar process, what it would look like, what the surface would be like, how light it was and other qualities of the fibre.

The foot was made by hand in a metal shop.

#### **(Upholstery:)**

The seat can be used as a bench, but is more comfortable with upholstery, which is the second part of the piece.

#### *(10. Trippel-Polster-Bild)*

And what makes it special: due to the separation of the shell and the upholstery the seat is highly variable. In form and style, the upholstery can be changed like clothing. For easy cleaning, the upholstery can be taken off and sent to the cleaners.

The chair can have summer or winter-clothes, young and even crazy or elegant and classic. The designs can also be personalised for individual customers. It allows a free play of interesting compositions, combinations of textiles, patterns and colors.

#### *(11. Photos von Skizzen zur Entwicklung von verschiedenen Formen der Polsterelemente)*

Even the shape of the upholstery can be individually designed. There is no limit except for the price...

One version has an extra upholstered „underdress“ combined with a blanket that makes it almost like a sleeping bag.

#### *(12. Photos von der s/w Version mit Decke)*

This design suits the taste and lifestyles of very different customers and can be adapted as their lifestyle changes over the years: Longevity and flexibility go hand in hand.

The cushions are made of natural fiber and natural latex, that can be recycled or burnt without toxic emissions. The cover can be made from linnen or wool or Bio-cotton.

Since the upholstery is an individual element of the seat, there are no, many times ecologically questionable, glues needed, like in some traditional upholstered-furniture.

*(13. Bild mit gelb gestreiftem Bezug und Person)*

### **Summary:**

The Prototype was first exhibited at the oekoRAUSCH festival in Cologne in 2009.

It is a first step toward optimising the form of the shell in order to create more seating-comfort and to develop the shell, the upholstery and the base further in detail for production.

I am still looking for a producer as a partner. So, if you know somebody, please tell me...

### **Evaluation:**

The probable cost and total energy consumption for the manufacturing has to be examined further. It looks like there may already be more established methods of production for the seating shell or at least in the near future, or ways of cold forming the Bioplastic material.

Also the question continues to be – and this concerns all natural renewable material –are there limitations for the use of land?

Let me quickly add the following:

What I am referring to is what I learned about sustainability through the designing process. I tried to make this seat as sustainable as possible. But I understood, that there are different opinions about whether it is sustainable or not.

The jury of the German eco-design prize (Bundespreis eco-design) had a different opinion. They decided that this design would „not lead to more ecological value“.

Trying to find out more about that, I presented it to Mr. Carus, who judged it a positive and interesting attempt and invited me to show the design at the congress...

It's important for me to know: Is my design environmentally defensible? If so, why? and if not, why not?

And then, how can designers get useful information for an acceptable price?

Thank you very much for listening!