

ADOBE STOCK

Natural Born Fillers

As lifecycle assessment and sustainable practices take on increasing relevance for yacht builders, so too does the search for alternatives to glass reinforced plastic, carbon fibre and conventional epoxy. Are natural fibre composites and plant-based resins viable alternatives for big-boat production?

BY CHARLOTTE THOMAS

When GRP first emerged in the mid-20th century, it changed everything. Its properties and its scalability revolutionised the leisure boat market. Over the decades its prominence grew to near ubiquity, even in the smaller superyacht size bracket. But with sustainability now central to brand strategies, the limited end-of-life solutions for GRP are coming under more scrutiny.

Enter natural fibre composites (NFCs). These draw on organic materials such as flax or even volcanic rock as their base and have the potential to provide the ease and performance of glass-fibre and epoxy-based composites without the emissions or environmental issues. Indeed, for one pioneering boatbuilder, NFCs could change the marine leisure sector by reducing reliance on GRP and taking it in a more sustainable direction. Greenboats is a German company founded in the early 2000s by Friedrich Deimann, who had trained as a wood boatbuilder.

“Friedrich worked for years building superyacht tenders at Yachtwerft Meyer using high-end composites and was fascinated by what was possible with them,” says Jan Paul Schirmer, joint managing director at Greenboats. “He did some research and discovered that natural fibres, and linen in particular, have very interesting mechanical properties but hadn’t found an application in boatbuilding. He decided just to go for it himself.”

Deimann’s first NFC vessel was a kayak that he finished in 2012. Key to the project were the flax fibres, clearcoat finish that would show the fibres, and the sourcing of plant-based resin, because if you use a natural fibre it defeats the object to dump it in synthetic resin.

“The eureka moment was to see the surface finish, because you can create a product that has more of the aesthetics of a wood product but technical properties of glass fibre,” says Schirmer. “There was no going back for him then. And it wasn’t about saving the planet either, it was about creating fascinating products with unique aesthetics.”



GREENBOATS



GREENBOATS

BUILDING THE BUSINESS

At first Greenboats focused on creating a portfolio of prototypes to prove the properties of flax-based NFCs. But that changed in 2016 when they built an NFC version of the Bente 24, a popular series 24-foot sailing yacht. The NFC version achieved the same weight and stiffness – and the same sailing performance – as the conventional GRP model. That sailboat was Schirmer’s own introduction to Greenboats. While working at Bente, he was shocked to see that the NFC-built yacht had an immediate and powerful impact on branding. “I figured if we can do that in a niche industry like sailing, what impact could we have on larger markets like automotive or renewable energy?”

Schirmer joined Greenboats in 2018 and helped propel the company from producing one-offs to building series boat and NFC components for other builders looking to make the transition. The process has not been straightforward. For one, the flax needed to create NFCs is not the typical twisted yarn that comes from the flax industry.

“It took us more than ten years to build a scalable and reliable supply chain because we need a flat, untwisted roving [essentially a ribbon of flax], and even today that is still in limited supply,” Schirmer explains.

This obstacle was partly solved in 2023 when Group Depestele, one of Europe’s largest private flax producers with plantations across Normandy, invested in Greenboats, ensuring the supply of flax roving that can then be used for the woven and bi-axial mats required for boatbuilding.

Schirmer admits that flax-based NFCs are still in their infancy and although they have been proven for boatbuilding across several

Facing page, from top:
The NFC kayak built by Greenboats founder Friedrich Deimann; the flax fibre hull of the Flax27 sailing boat by Greenboats.

projects – including Greenboats’ own Flax 27 daysailer – there are still hurdles to overcome.

“We say we have the performance comparable to glass fibre but the cost comparable to carbon fibre,” says Schirmer tellingly. “However, we have a portfolio of multi-axials and wovens that are like-for-like from a mechanical properties point of view and we can supply other boatbuilders with these materials. I think uptake has been slow not just because the materials are more expensive, but because it’s a much more advanced process and like any textile that absorbs water, the flax absorbs resin.”

On the one hand, this creates a composite that has good sound and vibration damping and insulation properties, but on the other means the process has to be a lot more controlled for variables such as humidity, temperature and pressure. To solve this, Greenboats uses vacuum infusion. As well as supplying raw materials, it offers large panels up to 6 metres by 2.5 metres for sandwich construction using various cores from balsa to recycled PET. It’s a side of the business that has drawn clients from the elite of sailing and Greenboat NFCs were used for hatches, panels and other items on the IMOCA 60s *Malizia* and the 11th Hour Racing team’s *Malama*, winner of the 2022-23 Ocean Race.

“We built the boat with sustainability in mind,” says Wendy Schmidt, a serial sailing superyacht owner and co-founder of 11th Hour Racing. “The IMOCA 60s are among the fastest monohulls in the world and you don’t sacrifice any performance when you are simply replacing some of the carbon fibre with things like flax or bamboo. I think the change begins with little things like that.” »

SCALING UP

Schirmer believes NFCs can replicate any GRP structure and Greenboats is already producing elements for the automotive, aerospace the renewable energy sectors: “We are still in the game of building infrastructure,” he says, “but hopefully that will lead to a big shift toward more sustainable practices.”

By extrapolating the number of tonnes of the long-fibre flax harvest and the percentage of that available to the industry, Schirmer estimates 30,000 tonnes of NFCs per annum could be used for boatbuilding in Europe, which equates to a significant proportion of the 5- to 9-metre leisure boat market, although there’s also plenty of scope for component parts in the larger yacht and superyacht segments such as ceiling panels and other interior components. Other builders are starting to take note, with production giants like Groupe Beneteau looking to introduce NFCs to some extent into their production processes, and other builders such as Amer Yachts considering using volcanic fibre-based NFCs for components instead of GRP.

In the superyacht sector, while natural materials such as flax, hemp and vegan leather are starting to become more common for interior finishes, Baltic Yachts has already taken a tentative plunge into structural NFCs with its Café Racer 68 model.

“There isn’t a better material in terms of properties than carbon fibre if you’re looking for strength, but not every section of the boat needs to be filled with those fibres,” says Henry Hawkins, executive vice-president at Baltic Yachts. “We wanted to prove with the 68 that we could combine carbon with NFCs. We have a full carbon deck for stiffness, but we were able to replace 50 percent of the carbon in the hull with flax. That was reasonably conservative.”

Hawkins concedes that there is a weight penalty, but also says that they could go further in terms of the proportion of flax in the hull, and the material also offers gains in areas like noise damping because it has higher density than carbon. He also admits they got the idea originally from Greenboats, but there was a previous Baltic yacht that set a precedent: the Baltic 130 *Swan Song* had an elegant interior by Nauta Design with tabletops and panels made from resin-infused linen to produce a glossy wood-like

FLAX & FIGURES

Flax has found its way into everything from canvas to banknotes to teabags. The plant grows from seed to harvest in 100 days, meaning two crops can be planted per year. “After cutting, the plant is left lying in the sun to rot a little in a process known as retting,” says Loris Schimanski, a boatbuilder and business developer at Greenboats. “Then the stalks are broken up and the long fibres are brushed out in a process called scutching. These are what are turned into a perfectly flat roving which we can then use to create our woven and multi-axial mats, which can be used like you would use glass fibre mat.”

What’s more, every part of the plant is usable. The stem parts can be used to make vegetal plastics, and the seeds are used to create linseed oil or the basis for the natural resins used by Greenboats. The crushed remnants of the seeds can be used for livestock fodder.



Right: Norbert Sedlacek, technical director of Innovation Yachts, has been instrumental in introducing volcanic fibres into yachtbuilding.

Bottom: Greenboat NFCs were used for hatches, panels and other items on the IMOCA 60s *Malizia*.



INNOVATION YACHTS

finish. Flax can be woven into linen and the boat was owned by Pier Luigi Loro Piana, famous for producing yarns and fabrics for luxury clothing and textile products. Loro Piana was keen to use the linen composite for structural purposes as well, but it was deemed a step too far a decade ago.

For Marion Koch using new materials and bio-based resins is not just an exercise in exploring new technologies but part of a larger imperative to introduce more sustainable boatbuilding practices. As Technical Director of Innovation Yachts in Austria, which has its main shipyard in the yachting heartlands of northwest France, she and her partner Norbert Sedlacek have been instrumental in introducing innovative volcanic fibres into yachtbuilding. Interestingly, their development work with the volcanic NFCs started at almost the exact same time Deimann was starting to explore flax.

The fibres are produced by a Belgian company called Isomatex. The volcanic rock is ground down, analysed for chemical and mineral content (adding minerals if necessary to ensure chemical consistency of the product), then melted and the resulting magma extruded into filaments.

“It has about the same density as glass fibre, but has higher mechanical properties so you need less of it to have the same effect,” says Koch. “The process of using it is pretty much the same as using glass fibre in vacuum infusion, although it took a while to find the right resin as the volcanic rock is hydrophobic. The fibres are also safer to work with because they’re not an irritant and the much larger particles don’t get into the lungs.”

It hasn’t been a straightforward path, however. When Koch and Sedlacek became aware of volcanic fibres in the late 2000s, they talked with manufacturers and decided the material was ready to start building with, until they realised there was a problem: the fibres were available in the form of the Filava continuous strands but, like Deimann had found with flax, there was no mat form essential for the laying up process.

“We started our first company in Austria called Fipofix, which stands for fibre positioning and fixation,” says Koch. “We developed machines to position the fibres and make a mat from which we could build a boat. We began in 2009 making the first tests with the fibre and from there we developed the process that led to us building the very first boat using volcanic fibres, which launched in 2012.” »

ROCK THAT BOAT

That first boat was a 16-foot Open 16 class yacht called Fipofix. The boat quickly proved herself with two non-stop crossings of the Atlantic with Sedlacek's son at the helm, setting several records in the process.

"It showed what the material can do and highlighted its qualities," Koch enthuses. "It's really a rock, which means it resists UV and water, and it's shock-absorbing as well as being both nice to work with and very stable. These are properties that make it very suitable for the marine industry."

Following the success of Fipofix and the development of the volcanic fibre mats and suitable bio-resins to go with them, the Kochs founded Innovation Yachts in 2016 and set about developing a much larger proof of concept that would also have less impact on nature.

"Our NFCs now comprise the organic, volcanic fibre and an epoxy resin which has a high bio-content in both the resin and the hardener and which doesn't use solvents," says Koch. "It's really great to work with and it's neutral as soon as it's cured, so there's no impact on the environment because water doesn't interact with it and wash all the nasty stuff into the sea."

In addition to using balsa wood from FSC-certified plantations for its core material to reduce environmental impact, Innovation Yachts put its volcanic NFCs to work in the Open60 *Ant Arctic Lab*, which is aiming to break records by attempting a single-handed, non-stop circumnavigation. Moreover, it is building a leisure sailing catamaran called the Volcat 16; a fleet of recyclable solar-electric, 10.6-metre charter cats; a 44-footer; and the recycled Lava330 tender. The company is also contributing to two EU initiatives aimed at developing green boatbuilding knowledge and skills across the industry.



BALTIC YACHTS



Above: The Baltic 68 Café Racer (profile below) combines carbon fibre with NFCs in her construction.

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NICHE OR NORM?

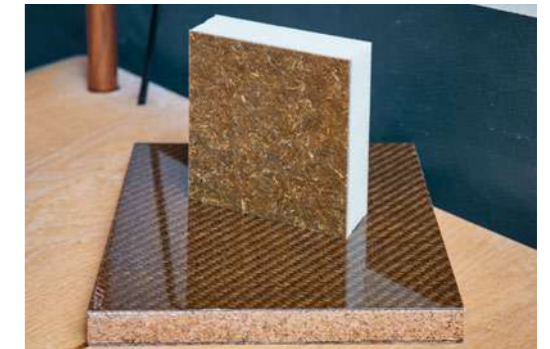
It's clear that something is going to have to change to ensure that yachts, and in particular superyachts, remain relevant and sustainable. NFCs are not a panacea, but they could play a significant role in the transition to more eco-friendly boatbuilding while offering clients something unique or aesthetically pleasing. There is, however, a learning curve to using NFCs and limited supply issues, which could limit its uptake in the short term.

"It's perfect for racing classes that don't use carbon and it's great for custom builds," says

BIO-RESINS

A key part of the NFC concept centres on the combination of natural fibres (and natural or recycled core materials) with plant-based resins. While 100 percent bio-resins are still a way away, both Greenboats and Innovation Yachts use resin systems that have a high bio-content and avoid harmful elements like solvents, and which have already been proven suitable for the marine environment.

"There's no excuse not to use at least 30 per cent bio content in our opinion, and we are working directly with suppliers of epoxidized linseed oils as a source," says Schirmer. "Our goal is to ultimately to reach 80-plus percent bio content in the resin, and in our laminate we have 90-plus per cent bio content, which means we're saving a lot of carbon in our materials. We're creating an organic product."



Koch. "It also has huge potential for production builders, but it's likely customers would have to pay a little bit more for their boats."

"Our vision for flax is that it could become the champagne of composites with really high aesthetics, high value and bespoke finishes," concludes Schirmer. "We see it as a new product category and we want to question consumption, or the way you build a product, or how a product can tell a story. It's still early days and the party has maybe just started, but it's going to change in the next five to ten years." ●