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From Fishing Net to Particle Foam

Expanded Polypropylene from Maritime Plastic Waste

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From Fishing Net to Particle Foam

Expanded Polypropylene from Maritime Plastic Waste

A large part of the plastic waste in the sea comes from the maritime industry. The Danish company Plastix recycles old fishing nets and ropes. The granules produced are used by JSP International, among others, to manufacture expanded polypropylene (EPP). This results in a 7 % reduction in CO_2 emissions compared to virgin material. In order to obtain the same properties as virgin material, the recyclates must meet strict requirements. This requires a precise analysis of the waste in the recycling process and strict quality control.

The fight against climate change and mismanagement in waste management are high on the global political agenda. Since the demand for plastics continues to grow in view of their advantages in many areas of application, plastic waste plays a major role in this. However, the processing of this waste has not kept pace with the growing demand. Since 1950, some 8.3 billion t of plastics has been produced worldwide. Half of this in the last 13 years alone [1]. This corresponds to approx. 400 million t of CO_2 emissions per year [2].

Plastic waste is mainly disposed of by

11 % of the plastic waste in the sea comes from the maritime industry. For the recycling of old fishing nets and ropes, accurate sorting is very important © Plastix

Fig. 1. Over 900 different types of nets and ropes are stored in the Plastix database. The "Wall of Fame" of the company shows an extract © Plastix

landfill and incineration. Both types have significant negative impacts on climate, wildlife and human health. The establishment of a functioning closed-loop economy and the recycling of plastic waste into high-quality, reprocessed raw materials have therefore become global megatrends. The governments of various countries and international organizations such as the EU and the United Nations are addressing the waste problem, for example, through political and organizational commitments aimed at greater climate protection and responsible consumption of raw materials. Both have been incorporated into the United Nations' goals for sustainable development [3].

In the maritime industry, the aim is to extend the useful life of plastics through reuse and recycling and to establish a closed loop economy for the plastics used. Millions of tons of plastics are already in the world's oceans. According to UNO and WWF, 15 t are added every minute. 11 % of this plastic waste comes from the maritime industry in the form of fishing nets and trawls, ropes and boxes [3]. It is therefore obvious that the maritime industry has an important role to play in preventing further pollution of the oceans.

Extended Producer Responsibility

This is also relevant for companies from an economic perspective. Due to the increasing Extended Producer Responsibility (EPR), in which producers are financially responsible for the waste management and recycling of their end-of-life products, companies have to deal with this issue more intensively [4]. Recently, several legislative initiatives have been introduced targeting the maritime industry, in particular a comprehensive European Union EPR, which will come into force in 2024.

The increased focus on effective waste management, EPR regulations and stricter legislation has significantly increased the availability of recoverable waste and recyclates and has led to increased cooperation between recycling companies and plastics producers. One such cooperation exists between the Danish recycler Plastix, Lemvig, and JSP International, Estrées-Saint-Denis, France. Among other things, Plastix recycles fishing nets and ropes that would otherwise end up in landfills or in the sea. The company was one of the first 13 companies in the world to participate in the United Nations Accelerator Program for Sustainable Development goals.

Recycling of Fishing Nets

Plastix purchases its plastic waste from ports, netmakers and plastic waste disposal companies worldwide. The in-house laboratory analyses, evaluates and records the recyclability of all incoming input waste streams based on their physical and chemical properties. Plastix cur-

Fig. 2. Mechanical recycling turns the maritime waste back into high-quality plastic granulate © Plastix

Fig. 3. Before delivery, the recyclates are analyzed and subjected to quality control © Plastix

Fig. 4. Feasibility study for the Urban Arrow Shorty cargo bicycle: the transport container was made entirely from Arpro 35 Ocean particle foam
© Urban Arrow, JSP

rently has over 900 different types of ropes and nets registered in its extensive database (**Fig. 1**). In the mechanical recycling process used, the input raw material strongly influences the consistency of the output material. Therefore, the company attaches great importance to the quality and homogeneity of the nets and ropes entering the recycling process.

Based on their physical, chemical and visual properties, the incoming nets and ropes are roughly sorted by material type and color and finely fractionated upon arrival at the factory. Non-recyclable materials are removed in the process. Sorting, fractionating and homogenizing the input material can be a labor-intensive step, as recyclability is currently not a major concern for either the manufacturers or the users of fishing gear. Plastix fishing gear recycling technology has been developed by combining tailor-made processing with adapted standard equipment to convert separated material into quality granulate for thermoplastic processing (**Fig. 2**).

After sorting and fractionating, the nets and ropes are shredded, washed, separated and dried. Finally, Plastix compounds and extrudes the processed input into new plastic granulate with constant and quality controlled physical, chemical and mechanical properties. All recyclates are analyzed, quality controlled, registered in the Plastix database and their properties are described in a specific data sheet (**Fig. 3**). This is a prerequisite for guaranteeing high quality recycled plastics. Plastix is certified for the recycling of used fishing nets and ropes from the maritime industry according to the ISO9001:2015 and ISO14.001:2015 standards for quality and environmental management.

The "green" plastic granules produced serve as raw material for a wide range of applications throughout the plastics industry. For example, OceanIX, a recycled product called rHDPE (recycled high density polyethylene) or rPPC (recycled polypropylene copolymer), is already being used for applications such as cell phone covers, designer outdoor furniture and kayaks. According to the company's product life cycle analysis (LCA), 1000 kg of OceanIX will avoid up to 1650 kg of CO_2 emissions if used instead of virgin material. »

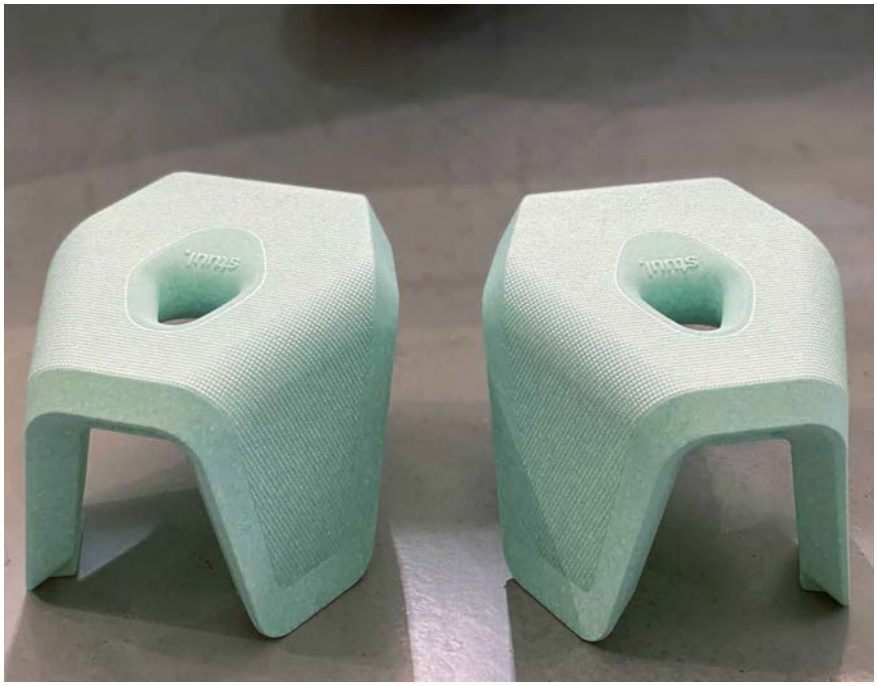

Fig. 5. Award-winning design: The two-part "stuul" bathroom stool has won three design awards. It is made of EPP with a 15 % recycled content © Juuce

Fig. 6. Atermit is bringing Arpro 35 Ocean back into the water in the form of a buoyancy aid for athletes © Atermit

Fig. 7. Artekno uses the EPP Arpro 35 Ocean © Artekno

EPP from Maritime Plastic Waste

JSP and Plastix joined forces in 2018 under the leadership of a Scandinavian initiative to investigate the possible use of recyclates from maritime industry waste for expanded polypropylene (EPP). The investigations led to the development of compatible grades, suitable process parameters for processing and analyses for quality assurance. With Arpro 35 Ocean a corresponding EPP was presented in March 2020. Arpro 35 Ocean is the first EPP with 15 % recycled content from maritime industrial waste and has a 7 % reduced CO_2 footprint compared to virgin material.

JSP's stringent recycled material requirements are key to ensuring material and processing properties areas close as possible to those of virgin material. Recent trials with different recycled material contents have shown that 15 % is the optimum percentage. The addition of more than 15 % recycled content from marine industrial waste slows down the extrusion process, thereby increasing production costs. This is due to the extended melting temperature range of the recyclate due to the different material properties of the processed fishing gear and ropes. A recycled content of 15 % currently represents the optimal ratio between recycled and virgin material to ensure certified material properties guaranteed by the manufacturer. The particle foam thus also meets the requirements for technical lightweight construction applications.

In the development of Arpro 35 Ocean, the focus was on meeting the technical requirements and conformity with the mechanical and thermal properties of virgin material. This is particularly important when used for technical, dimensionally accurate molded parts to ensure function and accuracy of fit. The particle foam is already being tested by various manufacturers and used in their products. Suppliers to the cargo bicycle manufacturer Urban Arrow, Amsterdam, Netherlands, used it to make a transport box for cargo bikes. The foamed Shorty EPP box produced for a feasibility study (**Fig. 4**) is made completely from Arpro 35 Ocean.

Other companies use EPP in commercially available consumer products, such as Juuce, Munich, Germany. The "stuul" produced by this company consists of two identical step stools which can be inserted into each other. This two-part design saves space in the bathroom and is very unobtrusive. The stuul was awarded the Universal Design Consumer Award 2019, the Good Design Award 2019 and the IDA Design Award 2019 (**Fig. 5**). The Finnish company Artekno from Kangasala also uses the particle foam for standard 6.2 and 15 liter thermo boxes.

Turkish company Atermit is bringing Arpro 35 Ocean back into the water in the form of a buoyancy aid for athletes (**Fig. 6**).

They are lightweight, mechanically resistant and heat-insulating. Such sustainable products are in demand in the currently booming food delivery market (**Fig. 7**). ■

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References & Digital Version

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German Version

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GREEN IS THE NEW BLACK

ARPRO is making waves in the mouldings industry. Targeting ocean pollution head on, ARPRO is making a positive environmental contribution by pioneering the first Expanded Polypropylene to use 15% recycled content from Maritime Industry Waste.

ARPRO 35 Ocean contributes to reduce CO_2(e) emissions by 7% compared to virgin material. By using ARPRO 35 Ocean you are helping reduce the amount of plastic waste entering the natural environment.

ARPRO Expanded Polypropylene is a 3D engineering material that delivers energy absorption with structural strength at very low weight. It also offers chemical resistance as well as thermal and acoustic insulation.

ARPRO is 100% recyclable.

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