Press Release

RAMPF – fewer fossil and more renewable raw materials

Group is researching the use of lignin in various polyurethane applications

Grafenberg, October 6, 2016. The "Pro Lignin" project, initiated by the German Federal Ministry of Food and Agriculture (BMEL), researched the substitution of fossil raw materials with industrially available by-product lignin for manufacturing high-quality plastics. As part of this project, RAMPF Polymer Solutions and RAMPF Eco Solutions worked on increasing the proportion of the bioplastic in various polyurethane applications – with success.

Lignin is a natural polymer that is formed in plants and ensures the lignification of fibers. More than 50 million metric tons of lignin are produced annually worldwide as a by-product of paper manufacturing. The vast majority of this is incinerated, even though its heating value is significantly less than that of heating oil.

Lignin is also far more valuable as an environmentally friendly component of plastics. The biopolymer has already been used to manufacture products that can compete with 100-percent petroleum-based polymer plastics when it comes to tensile, compressive, and flexural strength. The aim of the "Pro Lignin" project was to further drive forward this substitution of fossil raw materials with industrially available by-product lignin.

Intensive research

One part of "Pro Lignin" involved developing lignin-based resins, adhesives, foams, and casting resins. RAMPF Polymer Solutions, a leading developer and producer of reactive plastics systems based on polyurethane, epoxy, and silicone, joined forces with RAMPF Eco Solutions, a specialist in chemical solutions for manufacturing high-quality alternative polyols using PUR and PET by-products. Together, the companies tested a variety of technical lignins in polyurethane soft molded foams, casting resins, insulating foams, and integral foams.

Increased Shore values and improved compression recovery

The characteristics of the lignins were altered using a wide range of modifications and derivations. "During the tests, we determined that the dispersion properties of the lignin and the viscosity of the polyol/lignin mixtures are key to the quality of the end product. We also discovered that only extremely pure lignins without high levels of ash or carbohydrate are suitable for making high-quality polyurethane products," says Dr. Frank Dürsen, Director of R&D Future and Sustainability at the RAMPF Group. "It was only possible to integrate proportions of up to 30 percent into a polyol matrix when we used highly pure

lignins. Higher lignin proportions are only possible using lignin derivatives with a reduced molecular weight."

Up to 20 percent lignin was used in the A components of the molded foams. "This achieved an increase in the Shore values and improved compression recovery," says Dürsen. It was possible to use ten percent lignin in the polyol components of the casting resin formulations investigated. Here again, there was an improvement in the Shore values and other mechanical values such as the modulus of elasticity, tensile strength, and elongation at break in comparison to reference material with chalk as filler. Similar results were achieved in integral foams, where using lignin increased the tensile strength.

Results being built on in the "Lignoplast" project

The intense smell of the technical lignin grades has so far made their use in polyurethane applications difficult. "Significant improvements can be expected in this regard thanks to improved purification processes for technical lignins from the pulp industry and greater use of sulfur-free lignin extraction processes," stresses Dürsen.

The "Pro Lignin" research project is now finished. The RAMPF subsidiaries Polymer Solutions and Eco Solutions are currently applying the knowledge gained through this project to the "Lignoplast" project, which is also sponsored by the BMEL. In this group project, five research institutes and eight industrial companies are developing innovative processes for manufacturing aromatic synthesis components using various grades of lignin. They are also investigating how these can be used in adhesive, coating, polyurethane, and epoxy systems. "We have already developed some potential product applications. We see the greatest potential in insulating and integral foams, casting materials, and adhesives," says Dürsen.

More than competitive: The modulus of elasticity, tensile strength, and elongation at break of lignin-based PU soft and rigid foams, as well as PU casting systems developed and produced by RAMPF. Also shown on the picture is the reference material with chalk as filler.

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The RAMPF Group stands for **engineering and chemical solutions** and caters to the economic and ecological needs of industry.

The range of competencies includes:

> production and recycling of **materials** for modeling, lightweight construction, bonding, and protection;
> technical **production systems** for precise, dynamic positioning and automation, as well as technologies for complex composite parts production;
> comprehensive range of **solutions and services**, particularly for innovative customer-specific requirements.

With this know-how, RAMPF helps its customers to achieve profitable and sustainable growth.

The Group secures its presence on the international markets with more than 700 employees and six core competencies:

> **RAMPF Machine System**s based in Wangen (Göppingen), Germany, develops and produces multi-axis positioning and moving systems, trunk machines, and basic machines based on high-precision machine beds and machine bed components made from alternative materials.

> **RAMPF Production Systems** based in Zimmern o. R., Germany, develops and produces mixing and dispensing systems for bonding, sealing, foaming, and casting a wide variety of materials. The company also offers a wide range of automation skills relating to all aspects of process engineering.

> **RAMPF Composite Solutions** based in Burlington, Ontario, Canada, is a holistic composites supplier to companies in the aerospace and medical industries. The company offers a complete suite of services including composite part design and engineering, metal-to-composite conversion engineering, and composite manufacturing to very tight tolerances.

> **RAMPF Eco Solutions** based in Pirmasens, Germany, develops chemical solutions for the manufacture of high-quality alternative polyols from PU and PET waste materials. This expertise is also put to use in the planning and construction of customer-specific facilities for manufacturing polyols.

> **RAMPF Polymer Solutions** based in Grafenberg, Germany, develops and produces reactive resin systems based on polyurethane, epoxy, and silicone. Its product portfolio includes liquid and thixotropic sealing systems, electro and engineering casting resins, edge and filter casting resins, and adhesives.

> **RAMPF Tooling Solutions** based in Grafenberg, Germany, develops and produces board and liquid materials and semi-finished goods for cutting-edge modeling and mold engineering. The range of skills includes made-to-measure services and products such as pastes, large-volume and full-size castings for Close Contour models, and prototyping systems.

RAMPF has subsidiaries in Germany, the U.S., Canada, Japan, and China.

All RAMPF companies are united under a holding company – RAMPF Holding GmbH & Co. KG – based in Grafenberg, Germany.

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