Shaping more sustainable futures

Yacht building and pipelines rehabilitation with bio and styrene-free resins

Who we are

Family-owned business established in 1955 in Correggio mastering the production of specialty **Unsaturated Polyester Resins** and more recently of hybrid **Vinylester Resins**

The company aims at bringing **reliable and innovative solutions** to the industrial world of the future by growing sustainably with a human touch

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INDUSTRIA RESINE - VERNICI - AFFINI

Who we are

Carlo Riccò & F.lli continuously fosters its product portfolio innovation by investing in **new developments**:

One whole building dedicated to **QC** and **R&D**

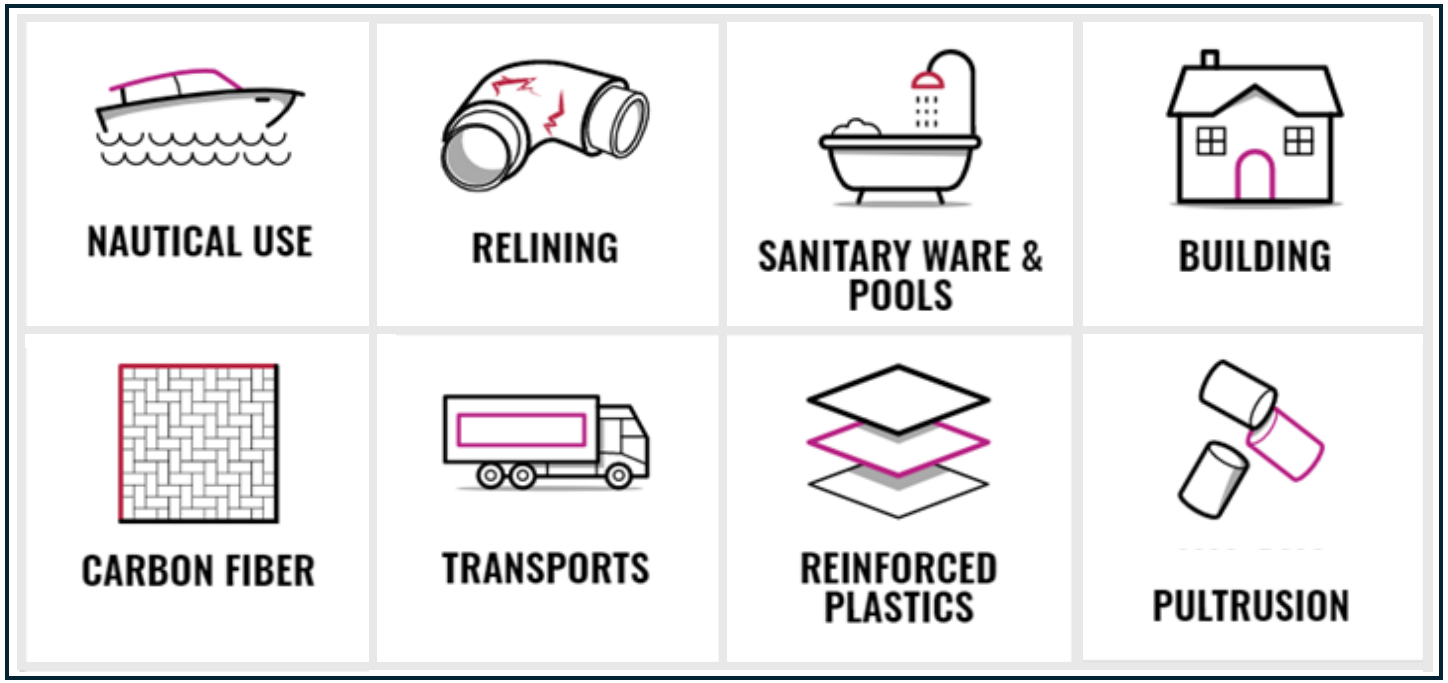
10 people working in the Lab

The most advanced **chemical and thermo-mecanical hardware**

UNIMORE Industrial PhD with focus on **Bio-resins**

Applications

Carlo Riccò & F.lli serves **deeptech composite applications** as:



Sustainability within UPR world

Producers efforts are declinated in different ways:

R-PET resins

Styrene-free resins

BIO Resins

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R-PET Resins

Using a **Recicled Raw Material**

Strongly dependant on **PET availability and price trends**

Fields of application limited by to the **darker colour**

On the market since decades, nowadays reborn thanks to the **automotive's focus** on recyled parts

Good performance as isophtalic resins (chemical, heat and hydrolysis resistance)

Styrene Free Resins

Styrene solvent is constantly under the regulators spotlight for its **strong smell/volatility** and **work-enviroment limitations**

Hard to be replaced because of cost and performance levels

In the market, some competitive alternatives: **vinyl-toluene**, **methacrylates** or other **styrene close relatives**

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Bio Resins

Replacing fossil-source raw materials (100% in classic UPRs)
with alternatives from **renewable** and possibly **non-food-competing sources**

Generally at least **15%** of **bio raw material** content

Mass-balanced "bio" raw materials exist and could potentially pave the way to 100% bio resins but aren't convincing

More recently C-14 lab tests (ASTM D6866) made it easier to measure

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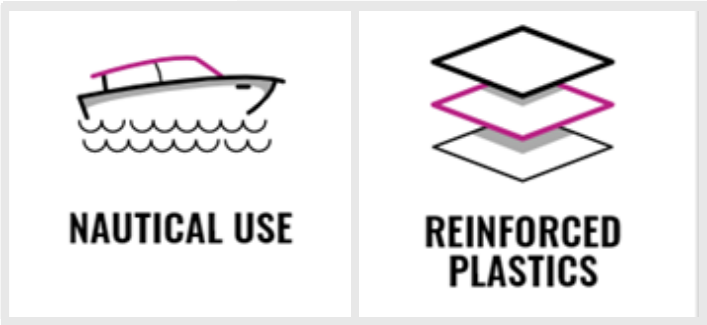
Bio isophthalic resin - LR 40 BIO HLU15

Suitable for **marine industry hand lay-up structural works**

Meets **Lloyd's certification** criteria

Strong **resistance to osmotic blistering**

Good thixotropy



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Bio isophthalic resin - LR 40 BIO HLU15

Liquid resin & curing characteristics:

Characteristic	Typical Value	Standard method
Styrene content (%)	41-44	UNI 9179
Viscosity (mPa*s at 25°C)	160-260	ISO 3219
Thixotropic index (Vi/Vm)	1,5-2,5	-

Parameter	Typical Value
Gel Time (minutes)	12 - 21
Exhothermic peak (°C)	170 - 195
Curing time (minutes)	27 – 51

Home Method
C68: Curing into DIN test tube in water bath at 60°C. Catalisys: 0,8% Perkadox 16® (Nouryon) + 1,0% Luperox P® (Arkema)

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Bio isophthalic resin - LR 40 BIO HLU15

Mechanical characteristics of the cured resin:

Parameter	Typical Value	Standard Method
Barcol Hardness	36	EN 59
Tensile Strenght (MPa)	58,4	
Tensile Modulus (MPa)	3640	
Elongation at break (%)	2,1	
Flexural strenght (MPa)	108,4	ISO 178
Deformation at break (%)	3,5	
Water absorption after 24 hours at 23°C (%)	0,25	ISO 62 met. 1
Water absorption after 28 days at 23°C (%)	1,05	ISO 62 met. 1
HDT at 1820 KPa (°C)	95	ISO 75 met. 1

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Bio isophthalic resin - LR 40 BIO HLU15

Bio content and C-14 measurement:

	Over 1000g of Diluted Resin				Over 1000 g of Alkyd Resin					Over Reactor Charge	
	$C_{(F+B)}$	C_B	C_B/C	m_B	$C_{(F+B)}$	C_B	C_B/C	m_B		C_B	m_B
LR 40 BIO HLU15	731,2g	90,9 g	12,4 %	18,7 %	574,0 g	175,8 g	30,6 %	36,2 %		30,6 g	33,1 %

Legenda:

$C_{(F+B)}$	Total carbon in the formula, the sum of C_B and C_F
C_B	Carbon from Bio Raw Material
C_F	Carbon from Fossil Raw Material
m_B	Total mass from Bio Raw Material

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Bio and Styren Free Resin - R 241 REL BIO

Suitable for **relining application (CIPP Technology)** with steam or hot water curing

To **eradicate smell related complaints** in lateral connection pipes rehabilitation in city centers and residential areas

RELINING

Good residual **stability** at room temperature

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Bio and Styren Free Resin - R 241 REL BIO

Liquid resin & curing characteristics:

Characteristics	Typical Value	Standard Value
Styrene content (%)	<1	UNI 9179
Methacrylate content (%)	48 – 52	ISO 3219
Viscosity (mPa*s at 25°C)	1000 - 1300	-

Parameter	Typical Value
Gel Time (minutes)	12 - 18
Exhothermic peak (°C)	160 - 175
Curing time (minutes)	15 – 24

Home Method
C68: Curing into DIN test tube in water bath at 60°C. Catalisys: 0,8% Perkadox 16® (Nouryon) + 1,0% Luperox P® (Arkema)

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Bio and Styren Free Resin - R 241 REL BIO

Mechanical characteristics of the cured resin:

Parameter	Typical Value	Standard Method
Barcol Hardness	50	ASTM D 2583
Tensile Strenght (MPa)	59	
Tensile Modulus (MPa)	3650	
Elongation at break (%)	2,1	
Water absorption after 24 hours at 23°C (%)	0,15	ISO 62 met. 1
Water absorption after 28 days at 23°C (%)	0,96	ISO 62 met. 1
HDT at 1820 KPa (°C)	98	ISO 75 method A

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Bio and Styrene-free Resin - R 241 REL BIO

Bio content and C-14 measurement

	Over 1000g of Diluted Resin				Over 1000 g of Alkyd Resin				Over Reactor Charge	
	$C_{(F+B)}$	C_B	C_B/C	m_B	$C_{(F+B)}$	C_B	C_B/C	m_B	C_B	m_B
R 241 REL BIO	587,2 g	89,3 g	15,2 %	18,4 %	573,4 g	175,7 g	30,6 %	36,0 %	30,6 %	33,1 %

Legenda:

$C_{(F+B)}$	Total carbon in the formula, the sum of C_B and C_F
C_B	Carbon from Bio Raw Material
C_F	Carbon from Fossil Raw Material
m_B	Total mass from Bio Raw Material

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In the pipeline

Record-high bio-content R 810-I PLT resin for pultrusion

	Over 1000g of Diluted Resin				Over 1000 g of Alkyd Resin				Over Reactor Charge	
	$C_{(F+B)}$	C_B	C_B/C	m_B	$C_{(F+B)}$	C_B	C_B/C	m_B	C_B	m_B
R 810-I PLT	696,7 g	286,8 g	41,2 %	52,4 %	583,7 g	432,1 g	74,0 %	79,0 %	74,0 g	77,9 %

Legenda:

$C_{(F+B)}$	Total carbon in the formula, the sum of C_B and C_F
C_B	Carbon from Bio Raw Material
C_F	Carbon from Fossil Raw Material
m_B	Total mass from Bio Raw Material