

ARKEMA

RILSAN[®] **PEBAX[®]**
RNEW

ADVANCED BIO-CIRCULAR MATERIALS

The circle of life meets the circular economy[®]

The story of Arkema's flagship polyamide 11 chemistry



THE ARKEMA OFFER

Advanced materials designed to sustainably meet the challenges of an evolving world

ADVANCED BIO-CIRCULAR MATERIALS

THE CIRCLE OF LIFE MEETS THE CIRCULAR ECONOMY



ARKEMA

ADVANCED MATERIALS

Arkema is a pioneer in amino 11 chemistry. Its flagship Rilsan® polyamide 11 and Pebax® Rnew® thermoplastic elastomers have a proven legacy in meeting some of the world's most demanding material challenges. Their trademark properties include light weight, flexibility, durability, energy return, and overall toughness.

They represent two families of highly differentiated advanced materials with a wide portfolio of options, including grades that are tailored for higher temperatures, high transparency, as well as functional characteristics like breathable and antistatic properties.

BIO-BASED

Arkema's amino 11 chemistry is derived from the castor bean, a more sustainable, renewable crop that does not compete with food and does not cause deforestation. Arkema is a leading driver of more sustainable castor farming in India.

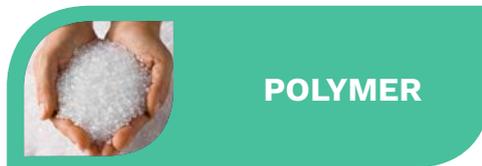
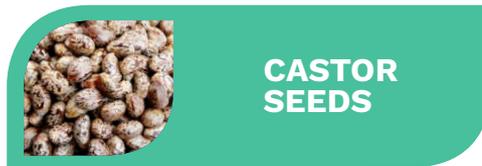
CIRCULAR

The castor bean is actually a seed. When planted, more seeds grow – the circle of life.

Further, Rilsan® and Pebax® Rnew® grades are generally recyclable. Arkema offers its Virtucycle® services to partner customers.

From castor bean to advanced polymers

A MIRACLE OF MODERN SCIENCE



UNIQUE PROPERTIES

from the repeating 11 carbon semi-crystalline structure



Bio-based



Easy processing



Low Density



Chemical resistance



Toughness



Dimensional stability



Abrasion resistance
(low friction)

HIGHER TEMP. ↗

TRANSPARENCY ↗

RILSAN®

POWDERS ↘

ELASTOMERS ↘

RILSAN®_{HT} FIRST FLEXIBLE PPA RANGE

→ Up to 70% bio-based

→ Up to 175°C continuous use in air

RILSAN®_{CLEAR} AMORPHOUS POLYAMIDES

→ Up to 60% bio-based

→ Transparency with durability

RILSAN®_{FINE POWDERS} HIGH PERFORMANCE POWDERS

→ 100% bio-based

→ Solutions for 3D printing, metal coating

PEBAX®_{RNEW} THERMOPLASTIC ELASTOMERS

→ Up to 97% bio-based

→ Wide range of flexibility and hardness

A Design Engineer's Dream



EXTRUSION

Extruded components such as medical catheters, flexible tubing, fibers, films, filaments.



3D PRINTING

Custom manufactured short run critical components, complex geometry, optimized shape design.



MOLDING

Molded parts such as fittings, connectors, flexible hinges, shoe components.



FOAMING

Extreme light weighting while retaining resilience and energy return.



FILMS

Breathable monolithic films for high comfort apparel. Permanent antistatic properties.

THE CASTOR BEAN

A TRULY REMARKABLE, RENEWABLE FEEDSTOCK



NO COMPETITION WITH FOOD / FEED



NO DEFORESTATION



**HIGHLY PROFITABLE FOR THE FARMERS (THE MAIN REASON
THEY GROW CASTOR)**



GROWN MAINLY IN INDIA ONLY IN THE POOREST SOIL



**THE BEANS ARE CRUSHED TO MAKE ~45% OIL AND 55% CAKE
(SOLD AS FERTILIZER)**

“

**A ‘kharif crop’, castor takes full
advantage of India’s natural monsoon
phenomenon ”**

ARKEMA

**is the world’s largest processor
of castor oil**

RENEWABLE FEEDSTOCK

Reducing dependence
on fossil fuels



OIL

→ “GEOLOGIC carbon”

Carbon is derived from ancient fossils

> 1 million years
to produce



CASTOR BEANS

→ “ATMOSPHERIC carbon”

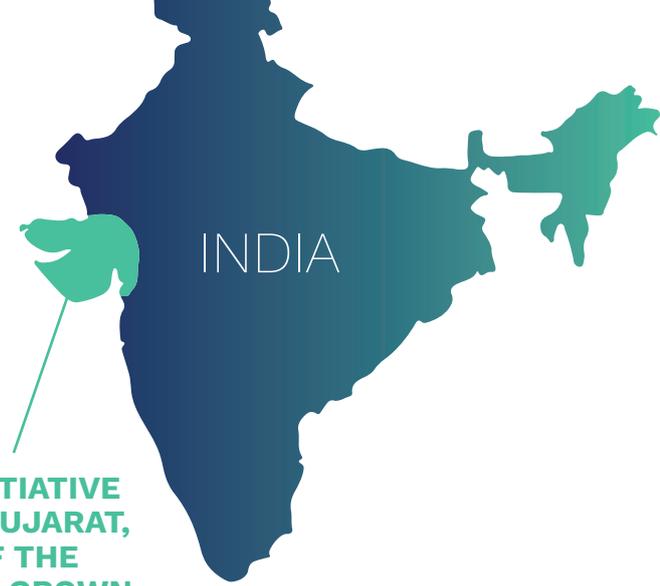
Carbon is derived from atmospheric CO₂

< 1 year
to produce

When climate change is calculated in terms of equivalent CO₂, the amount of CO₂ absorbed from the atmosphere is quoted as “biogenic carbon”. 100% of the energy of production (photosynthesis) is derived from sunlight.

PRAGATI

Driving sustainable farming



THE PRAGATI INITIATIVE IS FOCUSED IN GUJARAT, WHERE MOST OF THE CASTOR CROP IS GROWN

What

Enabling sustainable castor crop production by:

- Using good agricultural practices to increase yield and farmer income
- Efficiently using water resources and maintaining soil fertility
- Driving adoption of good waste management practices
- Enabling better health and safety practices, and respecting human rights

Who

- **Arkema**, a global leader in specialty chemicals and advanced materials
- **BASF**, the world's leading chemical company
- **Jayant Agro-Organics Ltd.**, a pioneer in castor oil based chemicals in India
- **Solidaridad**, an international civil society organization

When

- The Pragati initiative was launched **in 2016**

80%

OF THE WORLD'S SUPPLY OF CASTOR SEED IS PRODUCED ANNUALLY IN INDIA REPRESENTING APPROXIMATELY 1.6 MILLION TONS

“

‘Pragati’ is the Hindi word for progress.



50,000

Tons of certified castor beans cultivated from 2017 to 2022



6,250

Farmers Certified by the program so far



6,300+

Safety kits and crop protection product storage boxes distributed



80+

Villages have had their water quality tested while agricultural experts have facilitated soil sampling in more than 5 villages.

Some selected statistics as of December 2022



+15%



Yield per farmer increased by >15% vs. previous year; Year 6 yield is 22% higher than that published by the local government for this region.



96%



In year 6, 96% of farmers have adopted furrow irrigation, (a further 2.5% using skip furrow techniques) replacing less efficient flood irrigation.

Water consumption has been **lowered by approximately 30%** in the demo plots where water utilization is monitored.

→ More than **6,000 hectares** of castor beans farmed in accordance with the castor sustainability code -SuCESS™ (Sustainable Castor Caring Environmental & Social Standard) this year. (More than 19,000 hectares cumulatively)

→ More than **260 capacity-building training sessions** were held this year with farmers.

→ All certified farmers have adopted improved farm waste management practices

A proven legacy



1947

Arkema first commercializes amino 11 chemistry and its flagship Rilsan® polyamide 11 polymer. The beginning of a technological adventure!



**THE BIGGEST BIO-FACTORY
IN THE WORLD FOR
ADVANCED POLYMERS**

ARKEMA'S NEW POLYAMIDE 11 PLANT IN SINGAPORE IS 100% DEDICATED TO CASTOR OIL FEEDSTOCK

Arkema has chosen the location of Jurong Island in Singapore to build its new world-scale plant dedicated to the manufacture of the amino 11 monomer and its flagship Rilsan® polyamide 11 resins.

This 50% increase in its global capacities is a major vote of confidence in Arkema's commitment to offer advanced bio-circular solutions on a global scale.

ARKEMA'S VIRTUOUS RECYCLING PROGRAM

Specifically built for our partner customers



→ Arkema plays the role of “matchmaker” – matching customers who want to recycle, with those who want to source recycled materials

→ Agiplast, our expert partner in compounding and recycling is now part of the Arkema family

→ Case-by-case basis

→ Mechanical recycling = ~80% further reduction in CO₂

Let's grow together™

A VISIBLE AND RECOGNIZED Commitment to sustainability



Member of
**Dow Jones
Sustainability Indices**
Powered by the S&P Global CSA



BASED
ON SAM



TOP 1%

**THE SUSTAINABILITY
YEARBOOK 2021
BRONZE AWARD**

**3RD CHEMICAL
COMPANY IN
DJSI 2021**

CLIMATE CHANGE

Other rating +
Rankings



**1ST DECILE (GLOBAL)
JUNE 2020**



**EUROPE 120 &
EUROZONE 120
INDICES**



OCT. 2020

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