











Circular Economy Innovations: monomaterial solutions in aerosol actuators and caps

22 SEPTEMBER 2022



COSTER IN A NUTSHELL

-  Founded 1963 in Italy
-  Family and women-owned
-  Headquartered in Calceranica al Lago, Trento – Northern Italy
-  980 employees
-  16 manufacturing sites
-  Global presence in 11 countries in 4 continents
-  Over 4 BN products manufactured
-  3 business units: packaging, machinery, anodization

Coster is a multinational provider of spray packaging solutions. Its products are used on daily basis by millions of consumers all over the world in a variety of markets, ranging from personal care to households, perfumery and technical.

The company strives at making a positive impact on communities by **developing and supplying the most efficient and sustainable products.** It does leveraging on the knowledge of its organization, innovation expertise, sustainability leadership and manufacturing excellence.

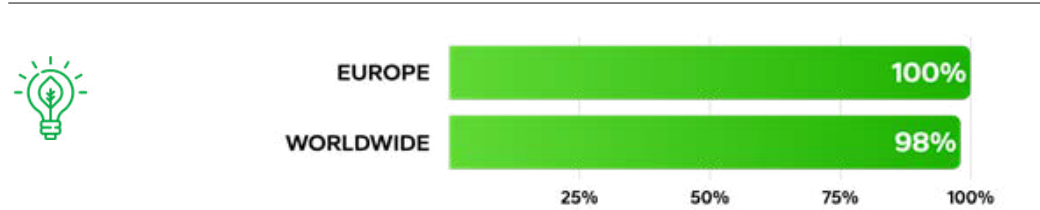


Sustainability at the centre of the development strategy

Sustainability is at the centre of Coster's strategy. The company is committed to make a positive impact and challenges itself to improve year after year. The roadmap will lead the company to full carbon neutrality (scope 1+2) by 2026, with 100% zero waste to landfill and energy sourced from renewable sources.

- 100% ISO 9001 manufacturing facilities
- CDP discloser
 - A- Climate change
 - A Supply chain
 - B Water footprint
- EcoVadis Platinum medal
- Global Commitment Signatories of Ellen MacArthur Foundation
- New Certifications Argentina gets ISO 14001 Spain gets Halal Certificate

USAGE OF GREEN ENERGY



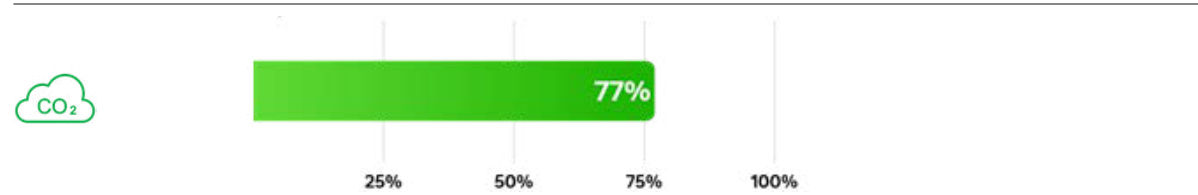
PHOTOVOLTAIC ENERGY vs 2018



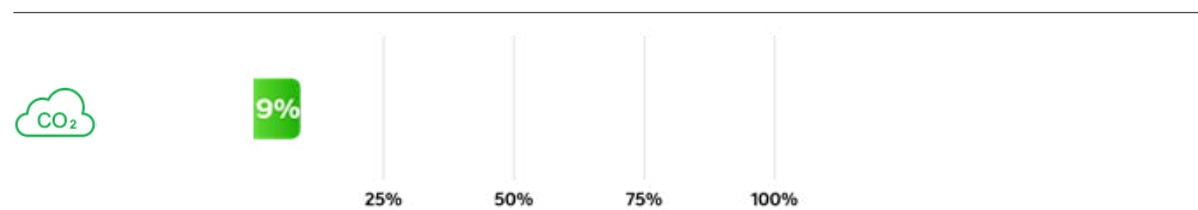
WASTE DISPOSAL REDUCTION vs 2018



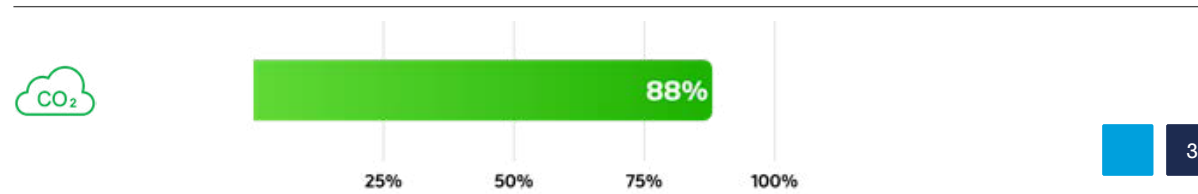
SCOPE 1 & 2 MARKET BASED EMISSION REDUCTION vs 2018



SCOPE 1 EMISSION REDUCTION vs 2018



SCOPE 2 MARKET BASED EMISSION REDUCTION vs 2018



Sustainability will continue to drive innovation efforts

Innovation and sustainability are two key growth drivers for Coster and the concepts go hand-in-hand. Coster is the preferred partner of many FMCG MNCs for their new product developments and keeps introducing novel products to the market that make a difference to consumers and the environment.



AWARDED INNOVATIONS

2015	2018	2019	2019	2020	2020	2021	2022	2022
ADF award	ADF award	ADF award	BAMA award	FEA award	FEA award	FEA award	ADF Awards	AEDA Awards
9.15 Fair Play Limit	Dior Very Cool Spray	AirNext	Texture Effects technology	L'Oréal Ushuaia	Glove-On	Vortex technology	Digital printing	Digital printing

REPLACE



REUSE



RECYCLE



SUSTAINABILITY ROADMAP

2026 TARGETS

As a global leader manufacturer in the Aerosol and Dispensing Packaging business, we at Coster consider sustainability with the highest importance and our responsibility towards all stakeholders both internal and outside our factories.

2026 TARGETS

- Carbon neutrality for Scopes 1+2 (Market Based)
- 100% energy and gas from renewable sources
- Zero waste to landfill
- ISCC+ certification in our facilities to use bio-based and renewable feedstock of raw materials
- Innovate reusable/recyclable/recycled-using product solutions
- Promote CosterCares program, addressing Education, Gender equality, Social inclusion
- Supply Chain emissions reduction
- SBTi targets submission



“3R” BASED INNOVATIONS

Replace

Glove-On
CosterEco



Reuse

Screwable pumps refill and
e-commerce ready



Recycle

PCR resins moulded components



INDEX

01

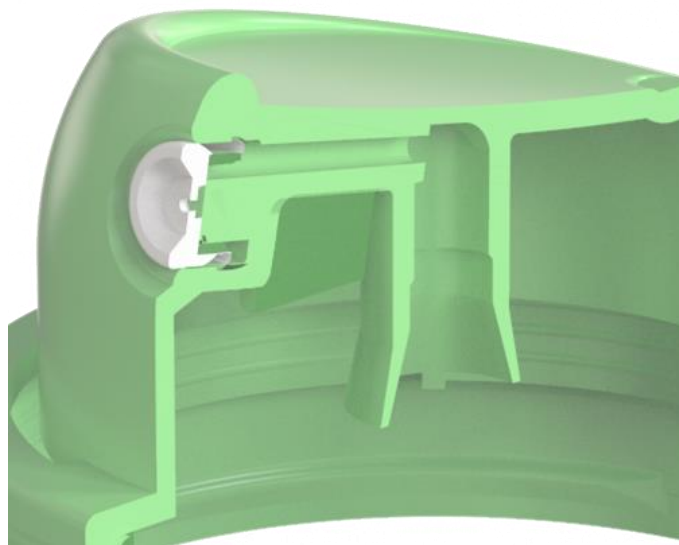
VORTEX



PATENT PENDING

02

PP INSERT



03

EASY OFF



PATENT PENDING

01. VORTEX TECHNOLOGY

Most aerosol **spray caps**
can be easily removed but
are not recyclable

#TODAY #ONTHEMARKET #NOTRECYCLABLE

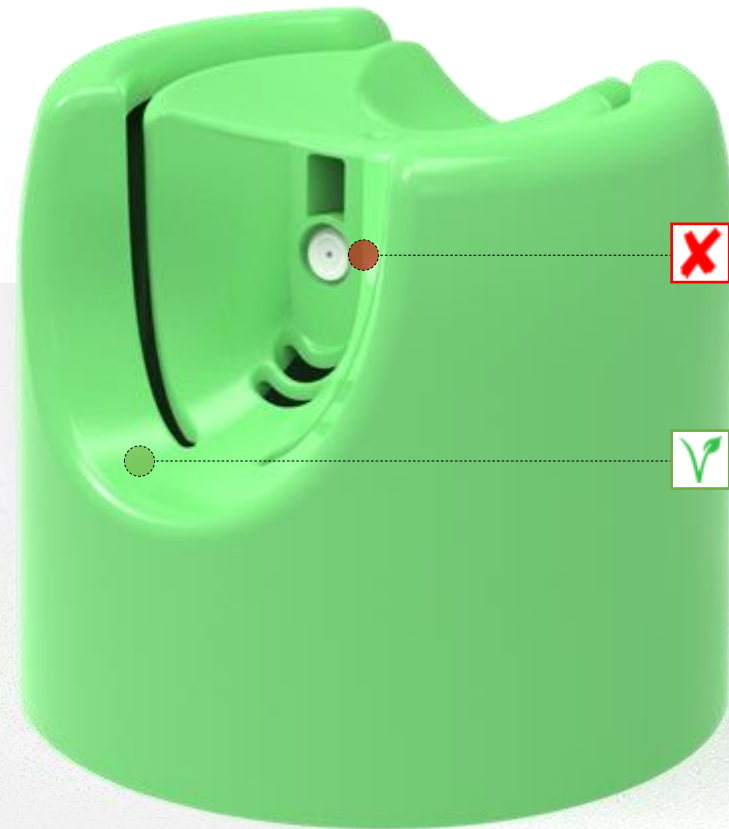


PATENT PENDING

01. VORTEX TECHNOLOGY

The POM (acetal resin) **insert**
is the **contaminating element**

#TODAY #ONTHEMARKET #NOTRECYCLABLE



Acetalic Resin - POM

Polypropylene - PP

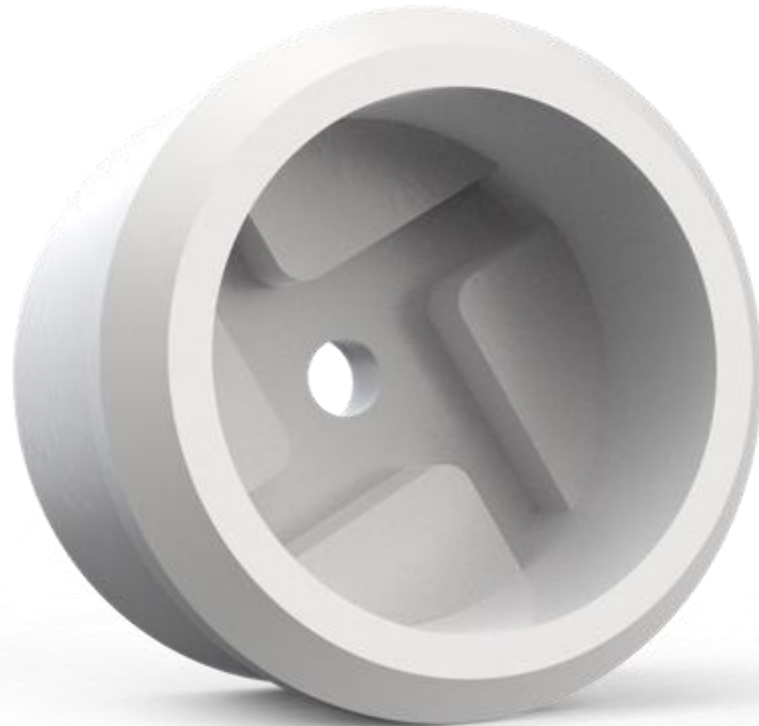
- **PP** (<1) and **POM** (>1) have a **different material density**
- **POM contaminates PET recycling streams**

PATENT PENDING

01. VORTEX TECHNOLOGY

Inserts are required for optimizing spray nebulization

#INSERT #TECHNOLOGY #NEBULIZATION



PATENT PENDING

- **Inserts** are employed to develop a **specific spray pattern**; different inserts develop different sprays
- They are **highly engineered** and **precision moulded**, with very narrow tolerances
- Industry employs **POM** as **most suitable** material to moulds inserts thanks to its properties
- Inserts mechanically breakup the spray, forcing the fluid through different channels and the small orifice
- The configuration acts to give the product a strong swirling action



01. VORTEX TECHNOLOGY

Today's insert-less spray caps show inferior spray performances

#TODAY #ONTHEMARKET #NOPERFORMANCES

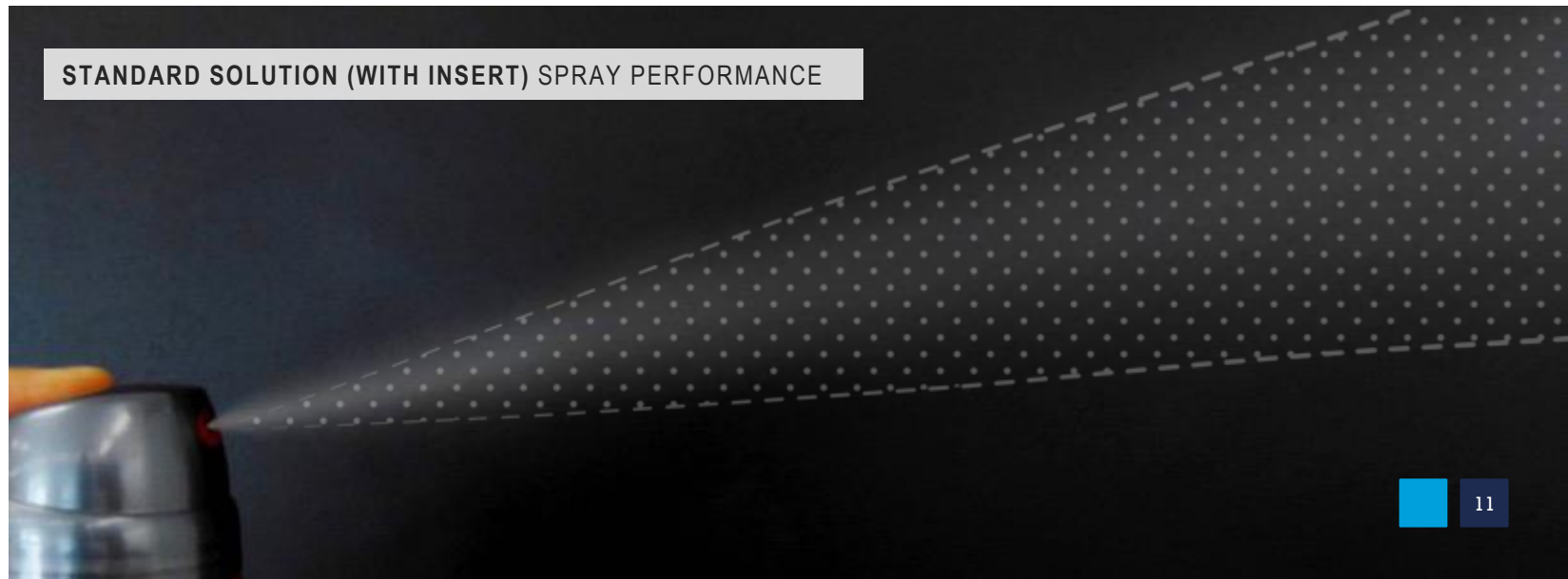
	INSERT-LESS CAP	CAP WITH INSERT
Particle size	Large particle size	Small particle size
Spray feel	Wet	Dry
Spray type	Irregular	Uniform

PATENT PENDING

CURRENT INSERT-LESS SOLUTION ON THE MARKET SPRAY PERFORMANCE



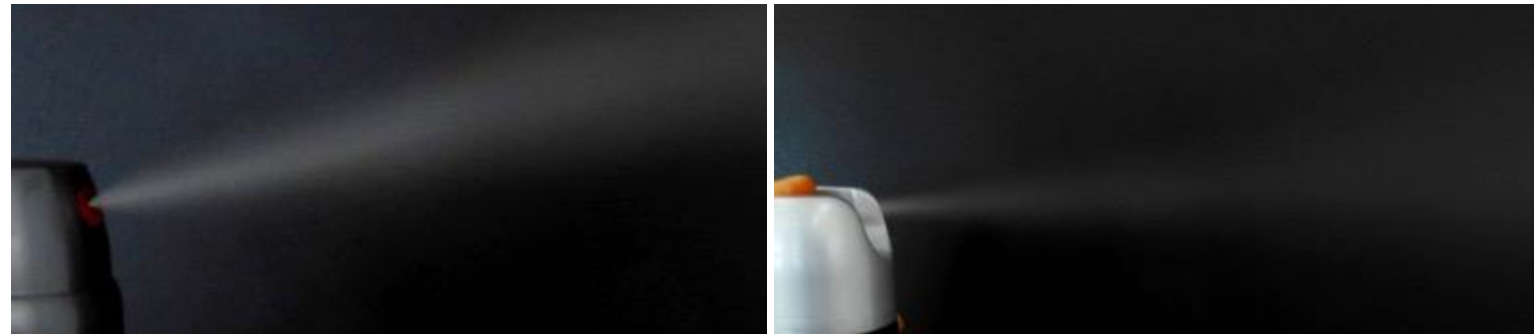
STANDARD SOLUTION (WITH INSERT) SPRAY PERFORMANCE



01. VORTEX TECHNOLOGY

An efficient **insert-less** spray cap would also present relevant **cost advantages**

#COST #INSERTLESS #EFFICIENT



	INSERT	INSERT-LESS
SUSTAINABILITY	● ○ ○ ○ ○	● ● ● ● ●
COSTS	● ● ○ ○ ○	● ● ● ● ○
SPRAY PERFORMANCE	● ● ● ● ●	● ○ ○ ○ ○

PATENT PENDING

01. VORTEX TECHNOLOGY

Coster has developed **proprietary**
“**Vortex**” **technology** to optimize spray
performance of insert-less spray caps

#COSTER #VORTEX #PERFORMANCE

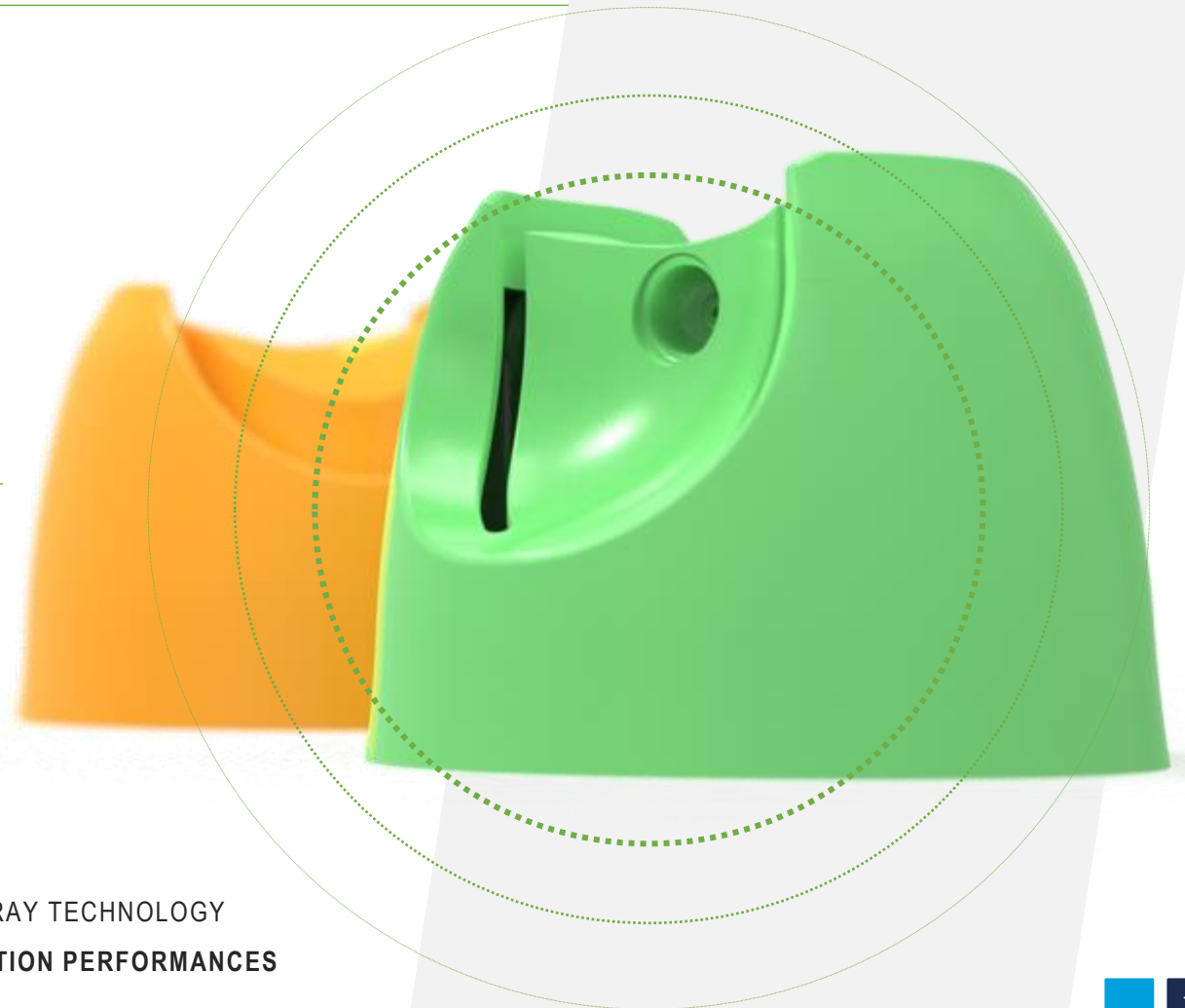
✓ **COST COMPETITIVE AS NO ASSEMBLY REQUIRED**

✓ **SPECIAL INSERT-LESS SPRAY TECHNOLOGY
WITH SUPERIOR NEBILIZATION PERFORMANCES**

PATENT PENDING

✓ **RECYCLABLE AS NO POM INSERTS ARE USED**

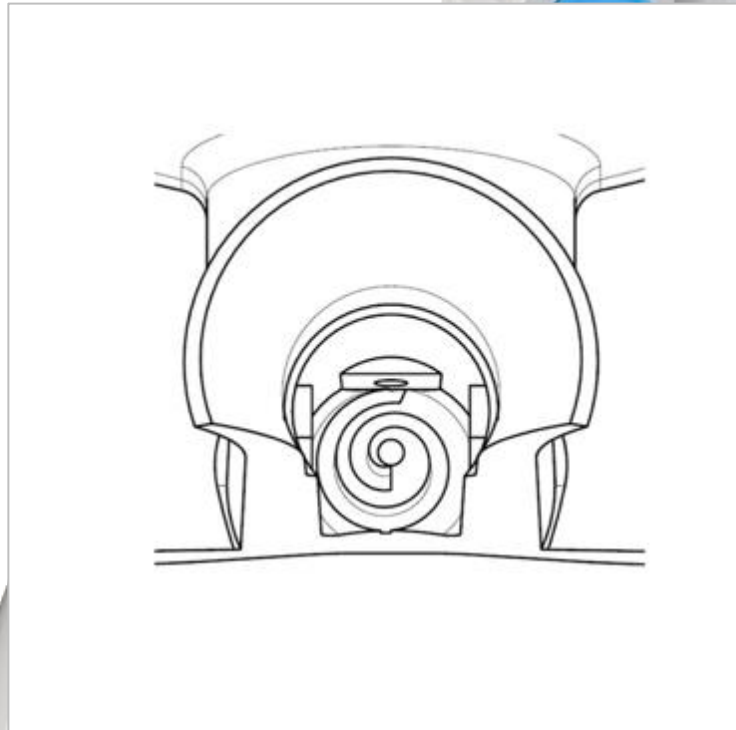
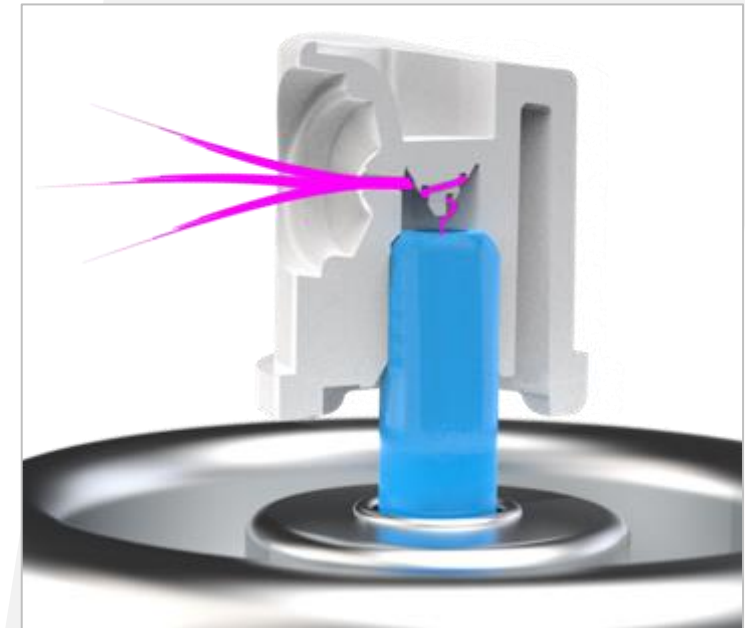
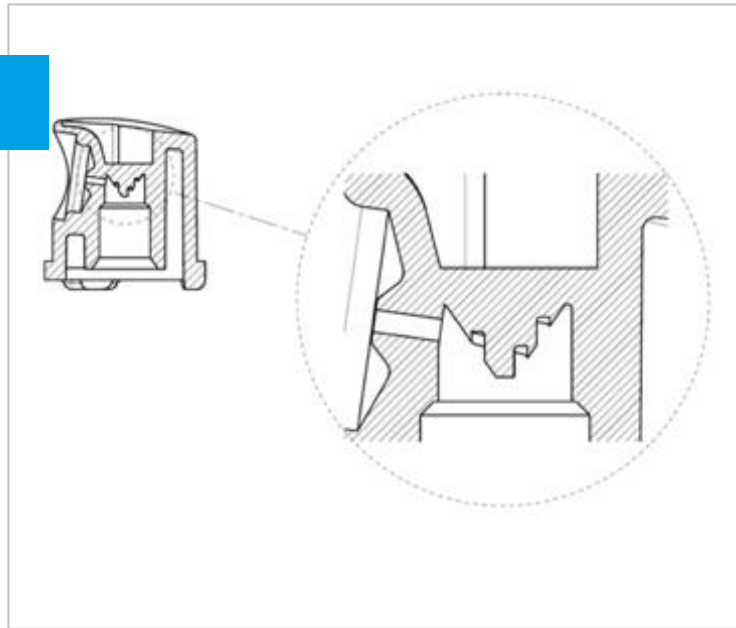
✓ **USE OF PCR IS POSSIBLE**



01. VORTEX TECHNOLOGY

Vortex technology recreates inside the spray caps the **same swirls generated by inserts**

#COSTER #VORTEX #PERFORMANCE



PATENT PENDING

01. VORTEX TECHNOLOGY

Vortex delivers a spray on par of spray caps with traditional insert

#VORTEX #PERFORMANCE #TRADITIONAL

STANDARD DEO ON THE MARKET

CONFIGURATION TESTED	INSERT DIAMETER [mm]	PRESSURE [bar]	PARTICLE SIZE [μm] (20 cm spray distance)					SPRAY ANGLE	DELIVERY RATE
			D[4,3]	Dv10	Dv50	Dv90	% V ≤ 10 μm [%]		
Current valve and actuator	0,6	3,60 bar	17,45	7,49	16,17	29,65	19,6	13,3 – 15,2	0,82 / 0,85
Current valve and Coster Vortex	0,5	3,60 bar	19,31	8,21	17,70	33,23	16,1	12,9 – 14,4	0,80 / 0,82

STANDARD HOUSEHOLD ON THE MARKET

CONFIGURATION TESTED	INSERT DIAMETER [mm]	PRESSURE [bar]	PARTICLE SIZE [μm] (20 cm spray distance)					SPRAY ANGLE	DELIVERY RATE
			D[4,3]	Dv10	Dv50	Dv90	% V ≤ 10 μm [%]		
Current valve and actuator	0,6	4,30	33,95	14,75	31,28	57,58	4,49	17 / 25	1,48
Current valve and Coster Vortex	0,5	4,24	36,44	13,86	30,43	60,03	5,04	18 / 25	0,89

PATENT PENDING

01. VORTEX TECHNOLOGY

Hair spray / Vortex technical comparison

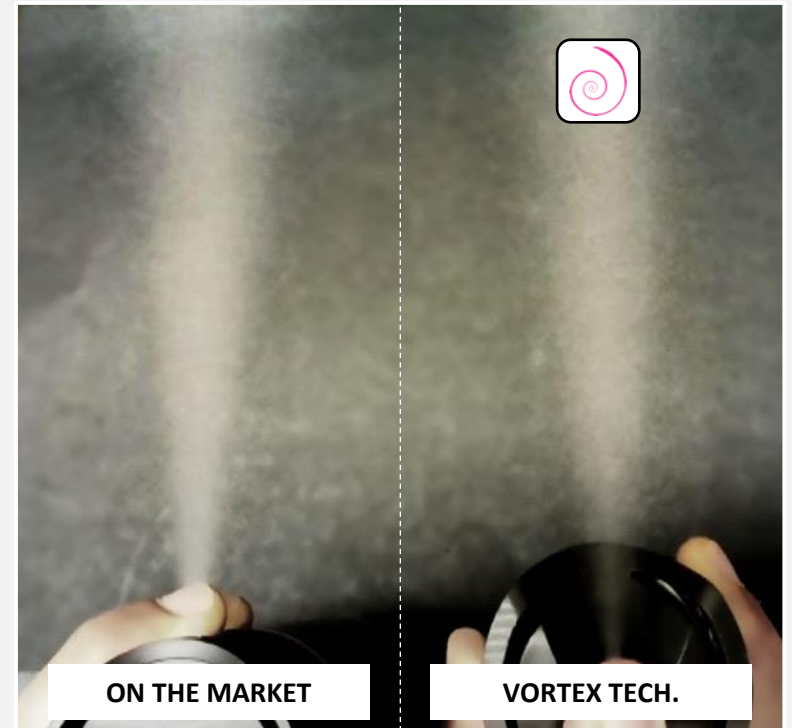


Test carried out

- Delivery rate (full can discharge)
- Pressure drop (full can discharge)
- Particle size (100% - 50 % - 25 % can content)
- Spray pattern (100% - 50 % - 25 % can content)
- Spray angle (100% - 50 % - 25 % can content)

Configuration tested

- Sample from the market
- Sample from the market + Vortex button + external shell

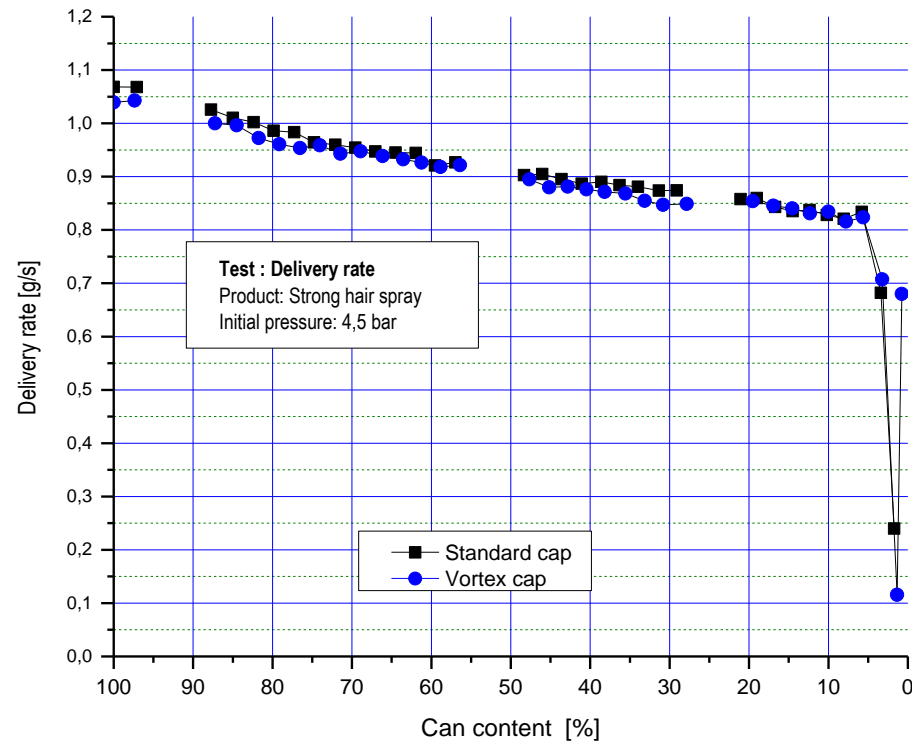


PATENT PENDING

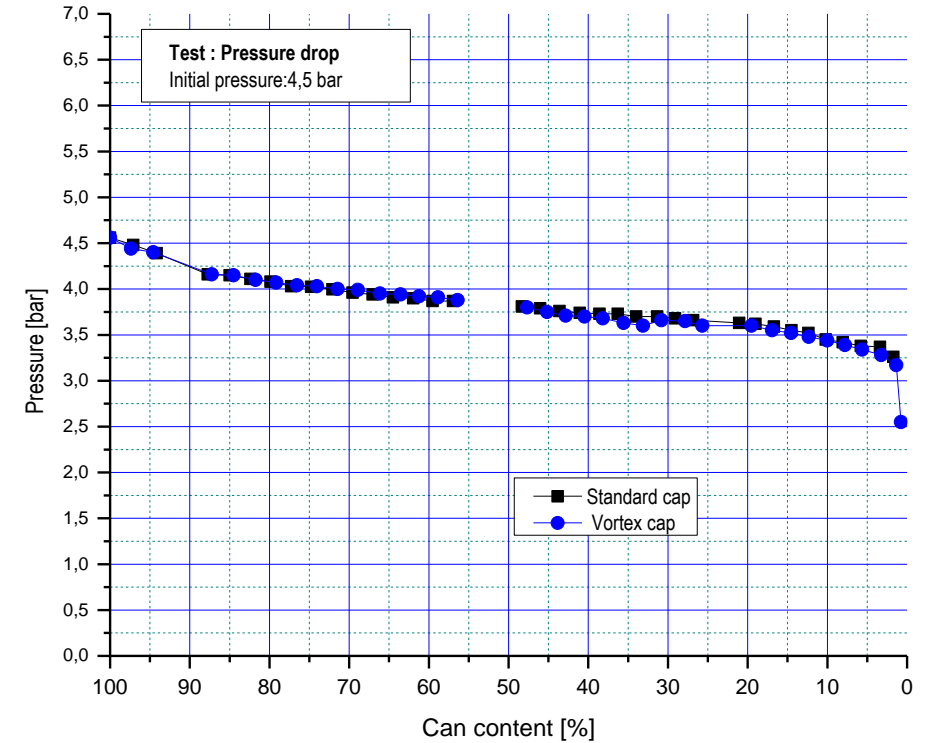
01. VORTEX TECHNOLOGY

Strong hair spray / Delivery rate - pressure drop comparison current cap - Vortex

Delivery rate



Pressure drop



PATENT PENDING

01. VORTEX TECHNOLOGY

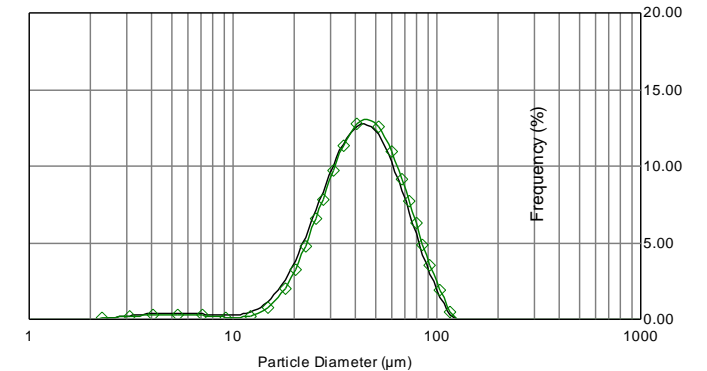
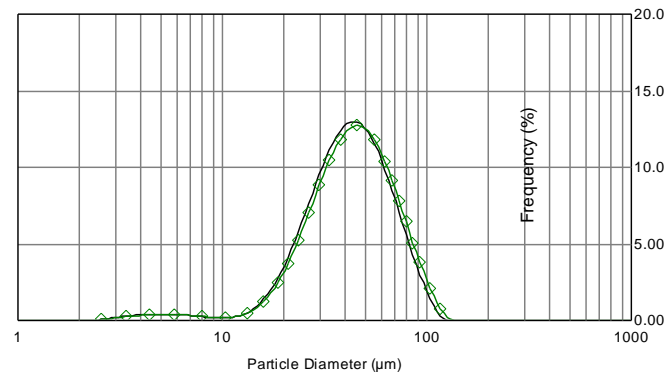
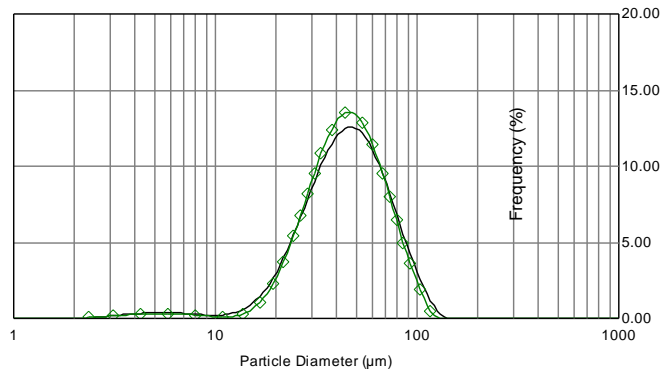
Strong hair spray / Delivery rate - pressure drop comparison with current cap - Vortex

Standard system

	PRESSURE [bar]	D[4][3] [μm]	Dv (10) [μm]	Dv(50) [μm]	Dv(90) [μm]
100 %	4,4	44,20	19,94	40,93	74,17
		45,30	21,67	42,20	74,35
		48,07	22,77	44,64	79,18
50 %	3,8	43,50	20,93	40,68	71,08
		44,50	21,83	41,83	72,69
		43,25	20,91	40,44	70,57
25 %	3,6	46,70	24,27	43,84	74,22
		44,30	21,38	41,43	72,30
		44,32	21,11	41,43	72,62

VORTEX

	PRESSURE [bar]	D[4][3] [μm]	Dv (10) [μm]	Dv(50) [μm]	Dv(90) [μm]
100 %	4,4	45,18	21,05	42,80	74,58
		47,24	24,12	44,30	75,58
		46,25	22,12	44,14	75,65
50 %	3,9	46,42	22,8	43,41	75,42
		46,77	22,45	43,57	76,65
		46,93	22,47	43,71	76,97
25 %	3,6	49,32	26,29	46,34	77,49
		48,15	23,48	44,84	78,54
		46,42	22,94	43,34	75,32



PATENT PENDING

— Standard cap
—◇— VORTEX

01. VORTEX TECHNOLOGY

Strong hair spray / Delivery rate - pressure drop comparison with current cap - Vortex

		PRESSURE [bar]	SPRAY PATTERN (30 cm)	SPRAY DIAMETER [cm]	SPRAY ANGLE [°]
100 %	STD CAP	4,4		D = 13,0	24
	VORTEX	4,4		D = 13,3	25
50 %	STD CAP	3,8		D = 13,0	24
	VORTEX	3,9		D = 13,0	24
25%	STD CAP	3,6		D = 12,0	23
	VORTEX	3,6		D = 12,7	24

PATENT PENDING

01. VORTEX TECHNOLOGY

Applications

Tested products

- Alcoholic Deo
- AP deo
- Sanitizer
- Hydro alcoholic
- Hair spray
- Air freshner
- Paint (under evaluation)

PATENT PENDING

COSTER

Vortex on
SPRAY CAPS



Vortex on
1" ACTUATORS



Vortex on
BUTTON ACTUATORS



01. VORTEX TECHNOLOGY

Samples of Vortex are available

technology to be embedded in new cap design

#VORTEX #SAMPLES #NEWDEVELOPMENT

Advantages:

- Sustainable: single material PP
- Cost effective: moulding only, no assembly
- Performance parity with insert solutions

Limitations:

- Design constraints (spray-out in axis with stem)
- 1 Vortex = 1 inserts; no multiple spray patterns possible

PATENT PENDING



SUSTAINABLE SOLUTIONS

INDEX

01

VORTEX



PATENT PENDING

02

PP INSERT



03

EASY OFF



PATENT PENDING

02. PP INSERT

POM inserts and PP development

- Today, inserts employed in both aerosols actuators / spray caps and actuators for pumps are moulded in **POM (polyoxymethylene)**
- Inserts are small plastic parts that allow to **mechanically break-up (MBU)** the liquid to dispense, ultimately defining the spray characteristics of the product (particle size, spray pattern)
- POM is universally considered the most suitable material for inserts as it presents excellent technical and mechanical properties for **high-precision small injected components**
- On the other side, POM's environmental friendliness is limited by following elements:
 - In PET recycling streams, it is considered an inseparable contaminant (both PET and POM have a density > 1)
 - With PP actuators, the POM reduces the valuable material content (recoverable recycled material)
 - During the injection moulding process it releases **formaldehyde**, a potentially hazardous element if not properly treated (i.e. exhaust)
- **Coster is developing a range of PP inserts in alternative to the POM, with following objectives:**
 - Performance parity
 - Same geometry/aesthetics
- **A PP insert permits to have a monomaterial actuator/cap, overcoming the above mentioned environmental issues**



MBU insert

02. PP INSERT

Available inserts

Coster's research and development successfully delivered three std Coster inserts in PP for test and trials by clients; these are:

- S9006.295
- S9005.296
- S9006.301

	S9006.295	S9006.296	S9006.301
N° of channels	4	3	6
Channel depth [mm]	0,30	0,25	0,4
Channel width [mm]	0,25	0,20	0,25
Entrance angle °	-	16	---
Channel outer diameter [mm]	-	3,20	---
Orifice geometry	Cilindrical	Cilindrical	Cilindrical
Diameter [mm]	0,5	0,3	0,50
Thickness [mm]	0,3	0,2	0,3
Prechamber	NO	YES	NO
Outer diameter [mm]		0,50÷1,00	

The employed material is a special **high stiffness PP homopolymer**; the inner part designs was reinforced to permit a correct fitting and strength within the actuator

S9006.296



S9006.295



S9006.301



02. PP INSERT

Additional PP insert developments in development pipeline

The new PP inserts (S9006.295 and S9006.296), compared to POM ones, guarantee same:

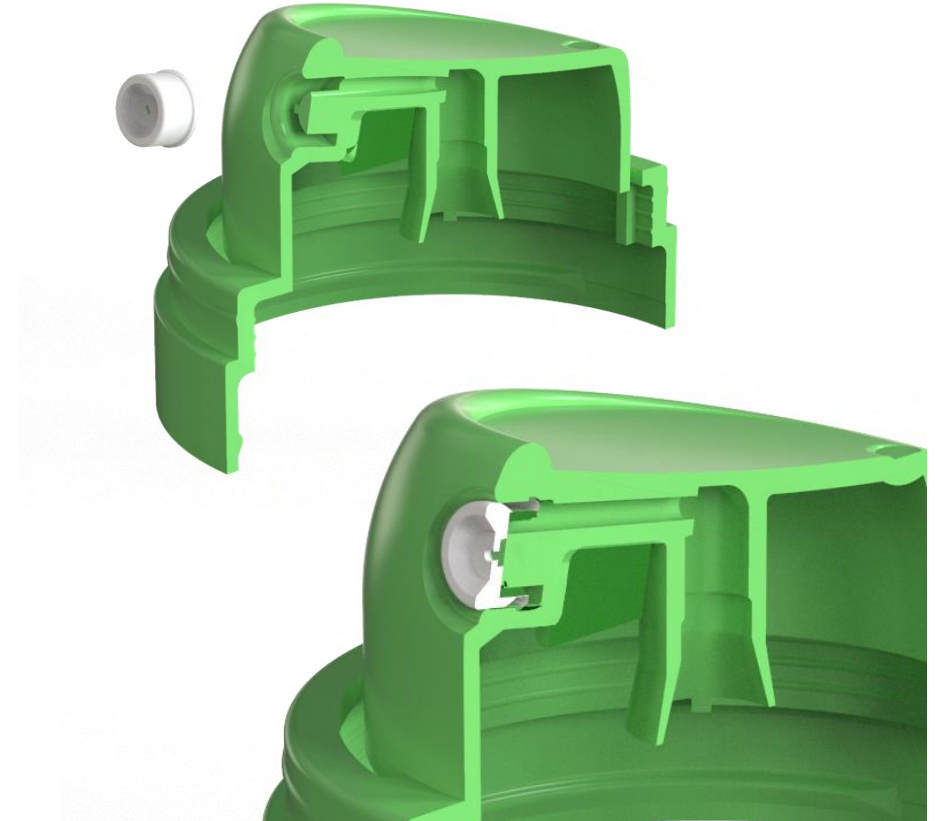
- Spray performance
- Insert retention
- Insert/actuator stability

Multiple tests have been carried out with positive tests (equivalent to POM inserts)

- Actuator block deformation
- Insert channel deformation
- Correct fitting actuator/insert
- Insert retention force/pressure (time/temperature – high pressure - air / water
- Chemical stress cracking
- Insert/actuator stability (functional test over time/temperature with different simulants/product/propellant)
- Over time with a wide set of simulants (alcohol based formulas, water based formulas, hair sprays, deos, lubricants, silicones)

Additional insert versions currently only available in POM can be developed in PP with a new specific pilot; thanks to the experience gained so far, Coster is confident to replicate any insert type in PP

A **new and dedicated mould** is needed to manufacture PP inserts; moulds for POM inserts cannot be reutilized for PP inserts



INDEX

01

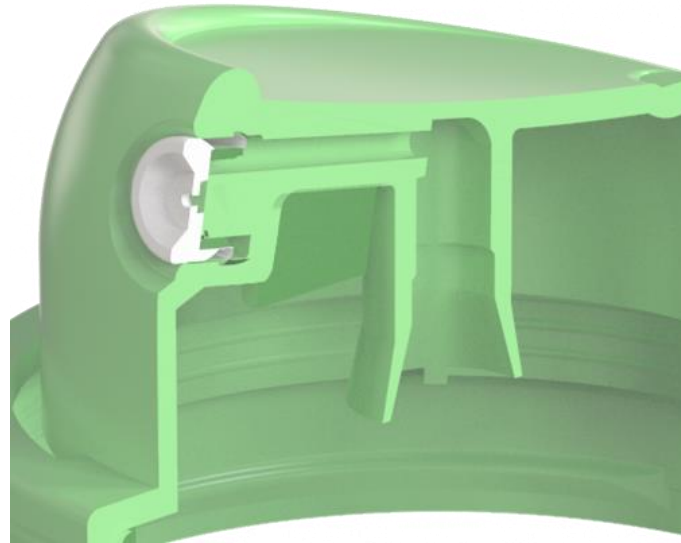
VORTEX



PATENT PENDING

02

PP INSERT



03

EASY OFF



PATENT PENDING

03. EASY OFF

Easy-Off technology can be embedded in new development for easy cap removal

#EASYOFF #REMOVE #RECYCLE

✔ STRONG **SUSTAINABILITY** FEATURE

✔ AVAILABLE ON NEW ACTUATOR (1") AND LARGER DIAMETER SPRAY CAPS DEVELOPMENTS

✔ SPECIAL **LATERAL LEVER** FOR EASY REMOVAL

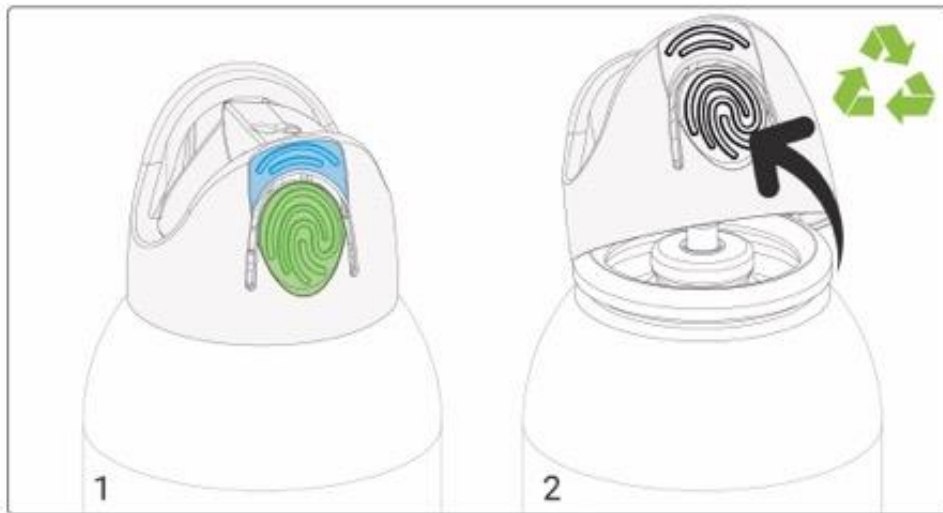
✔ **EASILY REMOVE** ACTUATOR OR SPRAY CAP



PATENT PENDING

03. EASY OFF

HOW IT WORKS:



1. **PRESS HERE** AND **PUSH** TO REMOVE THE ACTUATOR
2. THROW THE ACTUATOR IN THE **PLASTIC BIN**

PATENT PENDING





www.coster.com



www.linkedin.com/company/coster-group



sales@coster.com