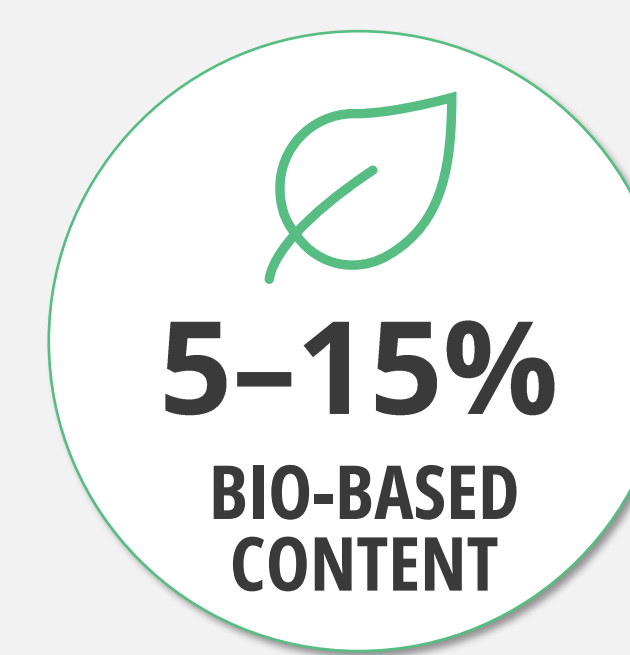
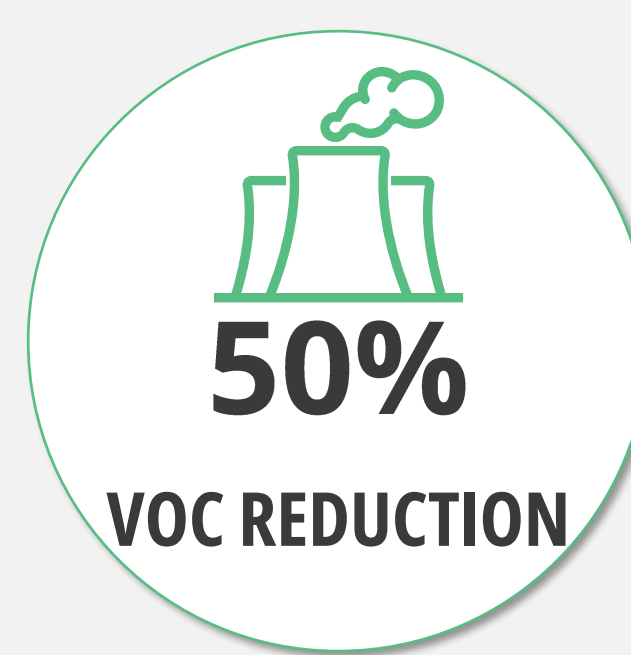


SSbD Guidelines

GLASS COSMETIC PACKAGING



THE GOAL "SLIP EFFECT"

Reduce product residue from **20% to ~5%**

THE SYSTEM

APPLICATION

Inner surfaces of glass cosmetic containers, such as 30 mL bottles for skincare products.

FUNCTIONALITY

Create a "slip effect" (omniphobicity) to reduce product residue waste from 20% to ~5%. The coating maintains transparency and aesthetics for luxury packaging while providing scratch, thermal, and chemical resistance. Additionally, it facilitates the cleaning and reuse of containers and refills.

MATERIALS

Hybrid sol-gel systems with high inorganic content, using metal alkoxides like tetraethyl orthosilicate (TEOS) combined with organic moieties. Formulations incorporate additives such as polydimethylsiloxane (PDMS), bio-based functionalized cellulose, and functionalized fatty acids.

TARGET STAKEHOLDERS

Cosmetic brand owners and the glass packaging industry, chemical formulators and converters. Also, regulatory and certification bodies.

KEY RISKS ADDRESSED

 HUMAN HEALTH Hazardous isomers & leachate cytotoxicity	 ENVIRONMENT VOC emissions	 CIRCULARITY Durability loss after washing	 PROCESS SAFETY Flammability & explosive vapor	 LCA & SOCIAL RISKS Ensure glass safety
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SSbD PRINCIPLES

Build safety and sustainability from the beginning.

 USE LOW-HAZARD SUBSTANCES	 AVOID PFAS & SVHCs	 USE BIO-BASED MATERIALS	 DESIGN FOR CIRCULARITY	 MINIMIZE EMISSIONS	 VALIDATE SAFETY EARLY
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RECOMMENDATIONS

 REDUCE TOXICITY Replace petrochemicals and PFAS by using functionalized fatty acid or cellulosic linkers.	 REDUCE VOC EMISSIONS Increase water:alcohol ratio to 42 → 50% VOC reduction.
 SLIP EFFECT & REUSE Cut residue from 20% to ~5%; enable reuse at home and refill.	 EARLY SAFETY SCREENING Pre-screen all chemical building blocks using QSAR + biomarkers + MTT assays (A549, HaCaT).

INDUSTRIAL PROCESS

- 1 SELECT FORMULATION**

Solvent-based utilizing mix of alcohol and water.
- 2 INNER SPRAY**

Rotating nozzle and long head to access the inner surfaces
- 3 CURING**

45°C (30 min) or 120°C (1 min) or UV (1 min)
- 4 QUALITY CHECK**

Uniform coverage, performance control

BIO-SUSHY RESULTS

Validated performance, safety, and circularity.

 20% → ~5% Product residue waste	 50% VOC Emissions reduction	 21 – 22 mN/m Surface energy (omniphobic)
 Transparency Luxury aesthetics	 Stable After 14 days of immersion	 100% recyclable Compatible with glass recycling

LIMITATIONS

 Aesthetics vs. bio-based content High transparency is harder to achieve with higher bio-based percentages.	 VOC reduction vs. oleophobicity Higher water content slightly lowers the oil contact angle while keeping functionality.
 Soft touch vs. curing efficiency Lower temps improve aesthetics but may reduce throughput.	 Scalability complexity Inner spray for small diameters needs specialized equipment.
 Cost constraints Bio-based materials cost more; target <20% cost increase	

ROADMAP

- 1 SCREEN SUBSTANCES**

Use CLP, REACH, QSAR & data-mining to assess hazards early.
- 2 SELECT SAFER MATERIALS**

Choose PFAS-free, bio-based, and with higher water content.
- 3 ADAPT FORMULATION**

Optimize network, water:alcohol ratio, and surface properties.
- 4 VALIDATE SAFETY & PERFORMANCE**

Check contact angle, scratch tests, MTT, stability, and safety.
- 5 ASSESS END-OF-LIFE**

Carry out LCA, and check reuse and recycling compatibility.
- 6 SCALE-UP**

Pilot batches 5–10 L, industrial spray, line validation.

