



## GFBIOCHEMICALS

### Foundation

- 2008

### Employees

- 50

### Branches

- R&D and sales – Geleen, the Netherlands
- Management, finance, marketing and legal – Milan, Italy
- Production plant, innovation and R&D – Caserta, Italy
- Pilot plant and application lab - Minneapolis, USA

### Key products

- Levulinic acid, Levulinate esters, Levulinic ketals, Non-phthalate plasticizers, Biopolyols, Formic Acid



THE LEVULINIC COMPANY

### Company

GFBiochemicals is the main producer at a global level of levulinic acid at commercial scale directly from biomass. The Company has a unique set of proprietary technologies that allow levulinic acid production with a one-step process directly from a wide range of cellulosic feedstock. GFBiochemicals' technologies lead to a combination of high product yields, high productivity, concentrated process streams and efficient recovery.

In 2016, GFBiochemicals made a downstream integration with the acquisition of Segetis' assets and IP portfolio of over 250 patents applications, including the Javelin™ ketal-technology; this acquisition enables GFBiochemicals a fast track to the market with levulinic derivatives applicable in a wide range of market segments worldwide.

### Industries

Levulinic acid and its derivatives have applications for a comprehensive range of industries. These include:

- |                             |                              |
|-----------------------------|------------------------------|
| ■ Green solvents            | ■ Pharmaceuticals            |
| ■ Resins and coatings       | ■ Agrochemicals              |
| ■ Polymers and plasticizers | ■ Fuel & specialty additives |
| ■ Flavors and fragrances    | ■ Biopolymers                |
| ■ Personal care             |                              |

**Applications:** Levulinic acid and its derivatives are used in many applications due to their diverse functionalities, such as:

- |                   |                               |
|-------------------|-------------------------------|
| ■ Degreasers      | ■ Cleaners                    |
| ■ Fabric Care     | ■ Resin Removers              |
| ■ Skin Care       | ■ Formulation Aids            |
| ■ Color Cosmetics | ■ Co-monomers & Intermediates |
| ■ Foams           |                               |

### Flavors

Levulinic acid has a creamy whiskey-like odor and adds caramel and maple flavors; its esters are used for fruity flavors and fragrances.

### Fragrances

Levulinic acid and its esters are used for a wide-range of flavors and fragrances. It also acts as a pH regulator and inhibits microbial growth.

Levulinic ketals are highly appreciated in fragrances because of their high solvency power for fragrance ingredients and solids, their ability to make compatible fragrances with soy waxes and as a phthalatefree fragrance fixative. In addition to this, levulinic ketals reduce VOC content in fragrance solutions.

### Coatings

Levulinic acid improves "processability" and reduces VOC in coatings, such as latex and polyester. Methyl Butanediol (MeBDO) derived from levulinic acid improves the durability of polyester coatings. Diphenolic acid (DPA) can replace bisphenol A (BPA), providing additional functionality, crosslinking and durable impact resistance.

## GFBIOCHEMICALS

### Contact

#### GFBiochemicals

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THE LEVULINIC COMPANY

Polyols based on the levulinic ketal technology are used in soft PU coatings with improved abrasion resistance.

### Biopolymers

Levulinic acid is a cost-effective building block for the production of PHBV products used for film, fiber, injection molding and extrusion applications. Such products have advantages compared to PHB, including improved fermentation yield, enhanced toughness and elongation properties. A wider processing window is also possible due to the lower melt temperature and crystallinity control enabled by levulinic acid.

### Personal care

As a renewable bio-based ingredient used for perfuming and skin conditioning, it is an alternative to benzoic or sorbic acid in preservation systems. Levulinic acid and its salts are already used in organic and natural cosmetic formulations with acidic pH.

Levulinic ketals dissolve a wide range of actives, while adding a light, dry emolliency; they have low to no odor and are compatible with many formulation ingredients.

### Households and Industrial Cleaners

Levulinic ketals are excellent degreasers and soil removers, while causing low skin irritation & sensitization and adding firmness to skin feel. Levulinic ketals are valued because of their intrinsic low odor and the stability they add in multi-component systems, by acting as coupling agents.

### Strippers and Graffiti Removers

As excellent solvent for resins and low VOC alternatives, levulinic acid ketals are used in paint strippers & brush cleaners, graffiti and adhesive removers.

### Agrochemicals

As renewable and low toxic solvents, levulinic ketals make pouring and spraying easier and are compatible with HDPE; agrochemicals formulations with levulinic acid ketals do not need special equipment or procedures during use.

### Additive and Polymers

The addition of plasticizers based on levulinic ketals offer good hardness efficiency and rapid dry blend time in phthalate-free formulations with low fusion temperatures.

### Foams

Polyols based on the levulinic ketal technology offer the opportunity to increase the bio-based content PU flexible foams without sacrificing performance. Moreover, they improve the rigid foam strength and insulation life-time. Their addition to polyester polyol formulations reduces the viscosity of the formulations for processing ease.



Biopolymers



Additive and Polymers