GLACONCHEMIE

CUSTOMIZED
SOLUTIONS

Let‘s talk
about
applications

GLY CASOL®

GLY CAMAL®

CUSTOMIZED
SOLUTIONS

GLACONCHEMIE
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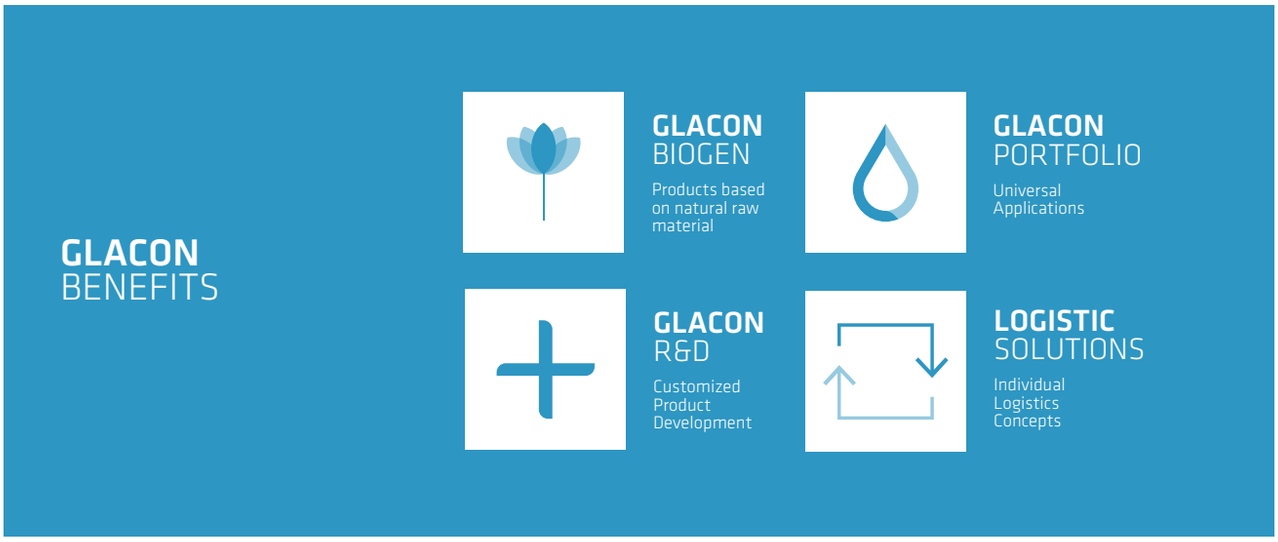
FEATURES AND APPLICATIONS OF BIOGENIC
GLYCERIN & GLYCERINDERIVATES



INTRO **GLYCERIN**

Without glycerine, numerous industrial applications would be unthinkable. The fields of application for glycerine range from the production of pharmaceuticals and the preparation of cosmetics to the production of foods and consumer goods. Glycerine is employed in the leather and textile industries, in metallurgy, in the production of adhesives, plastics, paper and packaging materials. It is an anti-freezing agent, lubricant and softener and is used for obtaining epichlorohydrine – an important component of diversely utilized epoxy resins. Glycerine does not only fulfill high requirements in the technical area, but also as sweetener and pharmaceutical ingredient.

In summary: Glycerine is a very special substance. However: all glycerine is not the same! One significant difference is whether glycerine is natural or synthetic, obtained from petroleum. At a closer look, the synthesis from this fossil resource with limited availability nowadays makes little sense, considering the fact that natural resources in sufficient quantities are sustainably grown or produced at our very door step, which are excellently suited for producing biogenic glycerine.

In the production of biodiesel from rape(oil), for example substandard glycerine is accumulated, from which GLACONCHEMIE obtains first-class, high purity pharma glycerine. The lipolysis

of vegetable oils is another significant source of high-quality glycerine. Furthermore, a number of raw materials can be gained from the released fatty acids for a multitude of new applications – a further important step on the way to saving limited resources, on which GLACONCHEMIE places high priority in our research and development activity.

Speaking of which: in our company guidelines we have committed to exclusively utilizing purely vegetable products for the production of pharmaceutical glycerine, with a strong emphasis on the aspect of sustainability. The company has decided that crude glycerine based on used cooking oils, which are originally of vegetable origin but in the course of their use have been mixed with fats of animal origin, will only be supplied for technical uses, the same applies to glycerine from the lipolysis of animal fats. It can not be permitted to produce a raw material, whose quality cannot be monitored down to the smallest detail, at the cost of humans and the environment, while adequate economical and ecological solutions exist, which are also safe for human health.

There is no question that these solutions exist for the production of glycerine, in form of nearly all common oleaginous plants including rape, sunflower, soy and oil palm. As long as sustainability is ensured, all pure vegetable oils must be considered as the raw materials of choice and should be preferred over animal products. This is especially the case when glycerine is used in the production of medical drugs, foods or cosmetics.

For the benefit of the consumer it is important to ensure that raw material sources are indeed faultless and safe. In animal products this can only be determined to a certain extent. Our pharma glycerine is not only of high quality and fulfills the strictest requirements – of the **European Pharmacopeia**, the **United States Pharmacopeia**, the **Food Chemical Codex** (FCC), the "**NON-GMO**"-standards of the European Union, the **HACCP** and the **DIN EN ISO 9001**, **DIN EN ISO 22000** and the **Kosher** and **Halal** guidelines.

Our glycerine is of vegetable origin.

GLACON
GREEM
CHEMISTRY

BIOGEN GLYCERIN& APPLICATIONS

Biogenic glycerine – naturally natural! Speaking of 'Green Chemistry': biogenic glycerine itself fulfills the criteria of 'Green Chemistry' in a unique way, including the basic principles for safety and sustainability. Compliance with the most important twelve requirements developed by P. Anastas1 can be summarized as follows:

• Biogenic glycerine is based on sustainable raw materials and therefore fulfills the requirement for a biogenic origin.
• Utilizing a by-product of another process, such as the biodiesel or fatty acid production, saves primary resources.
• Avoiding intermediate steps, many of which can be dangerous, reduces the consumption of raw materials and energy and limits harmful impacts on the environment.
• The manufactured high-quality product replaces products from non-renewable, fossil sources.
• The product is harmless for humans and the environment and
• It is safe in production and use.

For the validity and adherence to these criteria, the utilization of crude glycerine from 100 % natural sources is top priority for GLACONCHEMIE GmbH, in conformity with the company's guidelines.

Its convincing characteristics and its diverse possibilities of chemical reactions allow biogenic glycerine to become the 'progenitor' of a whole generation of 'green' substances: while the world still speculates2 and wonders3, GLACONCHEMIE already has chosen a way for producing industrially versatile 'Green Solvents', using biogenic glycerine of its own production.
Examples are the solvents isopropylidene-glycerine (**GLYCASOL**), glycerine formal (**GLYCAMAL**) and glycerine carbonate (GLYCANAT).

Guaranteeing safety for humans and the environment

For a long time, glycerine has been used in various applications and products which come in direct contact with humans,

• orally (pharmaceutical preparations, foods),
• dermally (cosmetics, pharmaceuticals),
• inhalative (tobacco smoke).

Accordingly, the practical experiences with the product also go back a long time. Just from this nearly historical fact alone could be assumed that glycerine is very well tolerated by humans and the environment. However, practical experiences do not provide sufficient proof for today's common and valid authorization and legal regulations. Consequently, even natural glycerine requires extensive investigations and the publication of the work carried out in authorization dossiers.
An excellent source is the "OECD SIDS Initial Assessment Report" (SIAR) for glycerine[4]. This report provides the following summary.

Human Health

Glycerine is of low toxicity when ingested, inhaled or on skin contact. It also does not show any structural alerts which might raise concerns about mutagenicity. Glycerine is not assumed to have any genotoxic potential. There is no reason for concern regarding carcinogenicity. No teratogenic effects were reported.

GLACONCHEMIE

CUSTOMIZED
SOLUTUINS

Research & Development

In order to maximize your added value, GLACONCHEMIE engages in Research and Development (R&D). It is our **aim** to **unlock the full potential of biogenic glycerine and to create glycerine specialties for your application**, which enables you to enhance your prospects on the market and to substitute valuable raw materials on the basis of limited resources such as crude oil.

We apply our innovation and performance in order to assist you to the best of our knowledge and judgment and to optimize your added value.

GLACON LOGISTICS CONCEPTS

In close co-operation we develop for you and with you logistics and service concepts that exactly fit your expectations.
We supply first-class, high- quality raw materials for you, so that you can offer your customers the best. We assist you in reducing storage costs by delivering just in time product quantities tailored exactly to your demand. We deliver in road tankers, flexi tanks, IBC or drums – just as you wish. We label, palletize and commission goods for you and transport solid or liquid substances, by road, rail or sea. You lower your expenses and raise your added value at the same time.

And if you need help handling permits and clearing formalities – we are there for you!

FEATURES OF BIOGEN GLYCERIN

A wide field of possibilities

Environment

Glycerine presents only a low hazard for water organisms (fish, daphnia, algae), with a PNEC (practical no effect concentration) of 780 mg/L. There is no evidence of impacts on sediment or terrestrial areas, as the distribution in soil and sediments is very limited, based on the very low log POW of -1.76. Consequently the potential for ground sorption and bioaccumulation is very low.
The calculated half-life for photo-oxidation is approximately seven hours. Under anaerobic conditions glycerine is easily biodegradable: 94% in 24 hours in water. (The cited SIAR offers the interested reader very detailed data and a number of references).

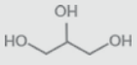
Safety

The safety-related properties of glycerine in production and application are mainly based on the extremely low vapor pressure and the excellent tolerance by humans and the environment. At normal temperature the vapor pressure is not sufficient to create explosive mixtures with air. As an organic substance, glycerine is combustible, but with an ignition point of 177 °C shows only low flammability. It also possesses no further dangerous properties and is therefore not subject to classification according to the CLP Regulation (EC 1272/2008), which introduced the GHS Globally Harmonized System of Classification in the EU. All in all glycerine can be rightly described as a 'pleasant example' among chemicals.

The physical properties of glycerine

Glycerine is a highly viscous liquid of slightly sweet taste. With a density of 1.26 g/cm³ glycerine is heavier than water, which it is entirely mixable with. Many applications take advantage of its extremely high boiling point or its extremely low evaporation rate. The indicated boiling point of 290 °C under normal pressure is only hypothetical, since decomposition already begins before. For distillation, greatly reduced pressure of 1 to 2 mbar is used, reducing the boiling point to 120 to 132 °C. Solidification occurs at 17 to 18 °C. However, glycerine shows a strong tendency for undercooling. If glycerine is mixed with water, the freezing point of the mixture can be reduced to well below 0 °C. The lowest freezing point of -46.5 °C is achieved by a mixture of two thirds glycerine and one third water. The pH-Value of a 10 % glycerine-water solution is at 7.0 neutral.

GLYCERIN
TECHNICAL CHARACTERISTICS

Physical properties of biogenic and synthetic glycerine		
		Glycerin
Synonyme		1,2,3-Propan - triol
CAS		56-81-5
Strukturformel		
Summenformel		$C_3H_8O_3$
Molekulargewicht		92,09
Dichte	20/20 °C	1,264
Siedepunkt		
760 mm Hg	°C	290
50 mm Hg	°C	202
10 mm Hg	°C	166
0,1 mm Hg	°C	91
Dampfdruck 20 °C	mbar (hPa)	0,0001
Schmelztemperatur	°C	17
dynamische Viskosität η / °C	mPa.s	945/25°C
Oberflächenspannung 20°C	dyn/cm	63,4/20°C
Brechungsindex n_D^{20}	- -	1,474
Dielektrizitätskonstante ε 25 °C	- -	47
Dipolmoment m 25 °C	D	2,56
Spez. Wärme 20 °C (liquid)	kcal/kg.K	0,57
Verdampfungsenthalpie	kcal/kg	158,2
Verbrennungsenthalpie (liquid)	kcal/kg	-4291
Standardbildungsenthalpie (liquid)	kcal/kg	-1736,83
Löslichkeit in Wasser	Gew. %	vollst.
pH-Wert 20 °C (10 Gew %)	- -	ca. 7,0
pKa	- -	14,15
Flammpunkt (PMCC)	°C	177
Zündtemperatur	°C	429
Explosionsgrenzen	Vol %	n.a.
Verdunstungszahl	(Ether=1)	n.a.
Verteilungskoeffizient n-Oktanol/Wasser	log P (o/w)	-1,76
Gefahrensymbole		- - -
R-Sätze		- - -
WGK		1
LD_{50} oral (Ratte)	mg/kg	27200
LD_{50} dermal (Kaninchen)	mg/kg	> 18700

Glycerine in use – a wide field of undreamed-of possibilities
Glycerine has proven to be an excellent solvent with diverse uses, especially for flavor and fragrance substances in foods and for active substances in cosmetics and pharmaceuticals. Additionally it acts as an excellent softener and plasticizer.Its strongly hygroscopic effect has boosted glycerine's career as a humectant.

The physical properties of glycerine – whether biogenic or synthetic – are described in the table on page 8. The macroscopic characteristic profile is based on three basic features:

- Hygroscopicity
- Low vapor pressure (high boiling point)
- High viscosity

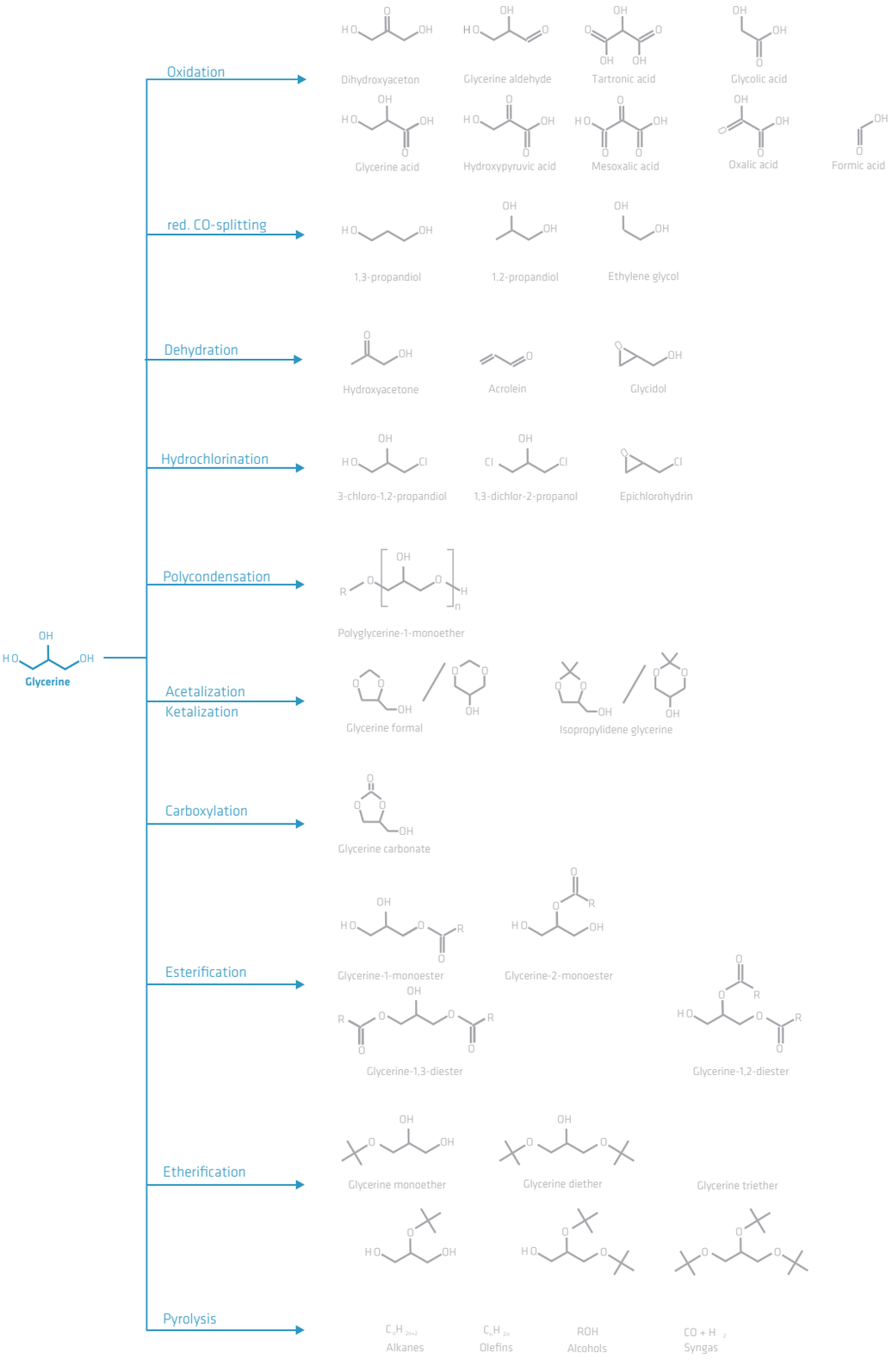
In 2002, approximately 500,000 tons of glycerine were produced worldwide. In the meantime this production volume has increased to approximately 2.0 Mio tons, combined with a likely change in the amount and emphasis of glycerine use. It can be assumed that a large percentage of the additional amounts are employed in thermal utilization. Another large field of application is the production of methanol – a particularly smart development in line with Green Chemistry, allowing the production of biodiesel from 100 percent renewable raw material. In the pharmaceutical industry glycerine is widely used as a solvent, as a vehicle for the active agent transport and as a humectant in textile wound dressings, to keep them soft and prevent them from sticking to the wound. Uses are found especially in dermatology and eye treatment. Glycerine also serves as a fermentation medium in the production of penicillin.
Cosmetics may be the oldest field of application for the use of glycerine. The reason lies in the compound's unique property profile. It serves as:

- Humectant
- Emollient
- Solvent and vehicle for active agents
- Viscosity-influencing agent
- Suspension of insoluble components
- Very good lubricating agent
- Anti-freezing agent in winter applications

Formulations can contain between 1 and 75 percent glycerine. A few examples:

Skin toning lotions	15 %
Dry skin lotions	10 %
Shaving soaps	2 %
Deodorants	20 %
Depilating Pastes	10 %
Eye cleaning	3 %
Face creams	5 -10 %
Liquid powder	5 - 8 %
Toothpaste	40 %

POSSIBILITIES OF GLYCERINE CONVERSIONS



GLYCERIN APPLICATIONS

by DI. Dr. Michael Charwath

In crèmes glycerine enhances the emulsifiers in O/W-emulsions and stabilizes the cream, while its softening effect is used in aftershave lotions, shampoos and foot care products.

In foods, concentrated flavor extracts are utilized by means of glycerine solutions; ethanol as a carrier medium has been almost entirely substituted by glycerine. Glycerine serves as a solvent for food colorings and as a humectant in sweets and dried fruits. During shock freezing it prevents ice formation in the tissue and therefore its destruction as a result of the otherwise occurring crystal formation. Glycerine is a natural by-product of alcoholic fermentation and therefore wine and beer may contain up to ten percent glycerine in relation to the alcohol content in the beverage. Furthermore, glycerine is used in basis extracts of soft drinks, as well as in syrup as a vehicle for the transport of flavor components. In the production of tea extracts, glycerine keeps the solutions clear during long storage periods.

Tobacco is one of the oldest applications. Glycerine prevents the drying and breaking of the tobacco and is also used for the integration of flavors and odorous substances. Cigarettes can contain between 2 and 4 percent glycerine.

Closely connected to the food industry is the application of glycerine as a plasticizer in cellulose films, which can contain amounts of 10 to 25 percent. Glycerine increases the elasticity and durability and prevents the shrinking of the film. Glycerine retains its effect even in a relatively low-humidity environment. Other tools for the cellophane production are also formulated with glycerine as a solvent (non-stick formulations, flame resistance). As it is edible and non-toxic, glycerine is the preferred plasticizer in food packaging.

Glycerine also acts as a plasticizer in the paper production, for example to prevent hard sheets at the calender. Other products utilizing glycerine are sanitary papers, which especially depend on softness and a comfortable grip.

In the chemical industry glycerine is employed for example in the production of nitroglycerine. Used in different types of dynamite, this is probably the most widely used explosive worldwide. A further application is the new, specific esterification with fatty acids into glycerine monoesters, which serve as diverse emulsifiers in the pharmaceutical, cosmetics and food industry. The etherification with fatty alcohols creates similar emulsifiers.

Synthetic resins: this field probably employs the largest percentage of glycerine as a raw material: it is integrated as a branch point into polyester chains, which are then esterified with unsaturated fatty acids (oil-modified polyesters, unsaturated polyesters). This creates reactive centers in the macromolecule, which react with suitable partners in a hardening process. As alkyd resins they contribute to a wide range of applications in lacquers, adhesives and other additives, and are widely used as unsaturated polyesters in combination with styrene as structural thermosetting plastics (glass-fiber reinforced plastics). Glycerine is also used in polyurethanes as a polyol component.

An important product derived from glycerine is epichlorohydrine, which is also used in synthetic resin chemistry. Before biogenic glycerine became available in large quantities with the biodiesel production, epichlorohydrin was a direct product in the production chain: propene – allyl chloride – epichlorohydrin – glycerine. Today the order is reversed, leading from the finished glycerine to epichlorohydrin, which is used on a large scale in the production of epoxy resins.

Another important field of application is the manufacture of industrial liquids, to a large part because of glycerine's effect of lowering the freezing point of a mixture, making it a valuable additive for anti-freezing agents, coolants and deicing agents. A further application in this area is in hydraulic liquids, such as brake fluids.

In lubricants, glycerine's large amplitude between freezing and boiling point allows a wide scope of application.
Especially advantageous is the utilization in apparatus used by the food industry. Glycerine-containing lubricants are resistant to hydrocarbons and are perfectly suited for the lubrication of rubber elements, which are sensitive to mineral oils.

Glycerine is an extremely important additive in the leather industry, from the first treatment of the 'Green Hides' to pre-tanning and tanning solutions, fat-liquid preparations, liming and hair-removal mixtures, dying, stain preparation and finish. It is regarded as a good solvent for dyes and guarantees a high penetration capability. Predominantly, however, glycerine is used for softening

leather and maintaining its moisture and elasticity. During the production of the tanning solution, potassium dichromate is transformed into alkaline chromium sulfate by means of glycerine. In the finish, glycerine finally provides the desired haptic characteristics, the typical leather feel.

In metal processing, glycerine is predominant-ly utilized in baths for electro-polishing, for example with stainless steel, or generally for anodic polishing. During the anodic oxidation glycerine prevents gas formation. It also plays an important role as a surface-active additive in soldering flux by ensuring the correct wetting of the adherents.

The ceramics industry uses glycerine in formulations for the prolonged binding of water: underglaze colors remain open for longer. In technical ceramics it acts as a lubricant. In the glass industry it is added to etching baths for fluoride because of its body, solubility and viscosity.

In agriculture additives, glycerine is favored for its qualities as a solvent, as a suspension agent, as a substance to improve penetration capability, for softening, as a humectant and anti-freezing agent. It can be found in care products for plants and animals, in insecticides and veterinary products.
Emulsions against the freezing of twigs and branches as well as pesticides contain glycerine. It improves fixation in insecticides and reduces consumption. In animal-based glues glycerine acts as a plasticizer and humectant. It is further utilized in dextrin-based adhesives (bottle labels, envelopes, book binding), which however are increasingly penetrated by synthetic materials.

The printing technology employs glycerine as an important basic material for printing and copying inks in various printing processes. It serves as solvent and humidity controller.

The textile industry takes advantage of the viscosity and hygroscopicity of glycerine for lubricating, sizing and softening of yarns and fabrics. Glycerine prevents the dehydration of the material, the bonding of natural and synthetic fibers. Glycerine is also used as a basis for water-repellent or flameresistant finishes.

Good prospects for glycerine and its applications

The worldwide biodiesel production has dramatically increased production volumes of glycerine to currently approximately 2 million tons, while the global demand for the above described applications lies at roughly 1.0 to 1.1 million tons.
Therefore, developing further ways of utilizing this valuable C3 raw material has become a new focus of consideration. Many groups of authors deal with the topic of glycerine application at least in theory and often arrive at very similar suggestions2,3,5. It should be mentioned that glycerine is not only a topic for scientific or technical discourse. Even the daily press has come to appreciate it in the context of the biofuel discussions[6].

What GLACONCHEMIE can offer you

GLACONCHEMIE produces biogenic glycerine exclusively from vegetable-based raw materials in three qualities, namely:

GLYCAMED® 99.7 %
GLYCAMED® 86.5 %
GLYCATEC® 99.5 %

GLYCAMED® is high-purity glycerine in pharmaceutical quality and fulfills the requirements of the European Pharmacopoeia (EP) and the United States Pharmacopoeia (USP) as well as the Food Chemicals Codex (FCC). The product with a concentration of 86.5 % purity is used in cosmetics and special applications. Since glycerine is exclusively based on vegetable materials, products certified as KOSHER or HALAL can be delivered as well.

GLYCATEC® is high-purity glycerine for all technical purposes.

Outlook – or: All that remains to be said

Of course biogenic glycerine is not the only substance on the list of green chemicals. However, its incredible diversity of applications can hardly be achieved by other products. This shows the important role biogenic glycerine can play in the concept of Green Chemistry by bringing each product it is used for, as a raw material or formulation component, closer to fulfilling the requirements of Green Chemistry. Utilizing glycerine may not turn these products into 100 percent 'green' products, but the concept of Green Chemistry and its dissemination are supported on a large scale. Sources of its production lie predominantly in the biodiesel production, but also exist where fats are produced on a large scale.

References

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GLACON
GLYCERINDERIVATES

GLY CASOL®

GYCASOL® and its application

2,3-O-Isopropylidene glycerine I is a monovalent, primary alcohol, which may be formally described as methanol substituted by a cyclic ether group.

Owing to these two chemical groups of different polarity the molecule shows high affinity to polar as well as to less polar or even up to non-polar substances. As an outstanding property in this sense the complete miscibility with water may be mentioned. At the same time isopropylidene glycerine is miscible with nearly all other groups of organic substances. For these reasons it is especially qualified for the use as solvent for very miscellaneous applications.

The most important industrial applications will be found in colours and varnishes, printing inks, adhesives, pesticides, detergents and cleaning agents or metal cleaners, emulsifiers and dispersants or extracting agents. But beside its function as a plain solvent isopropylidene glycerine can exhibit discrete lacquer-forming properties like retardation of drying or film formation.
Isopropylidene glycerine is being appreciated for years by cosmeticians as ingredient in personal care products, perfumes and essences.

The alcoholic hydroxyl functionality of the molecule allows for the participation as building block in many reactions. Within condensation reactions causing the release of water isopropylidene glycerine is being incorporated into polyesters, polyurethanes, polyacrylates, polyethers et cetera, in order to modify their properties. The reaction with anhydrides and acids will yield esters. Results of our lab experiments addressing the characterisation of this substance are available on request.

Toxicity and safety

According to GHS we have classified Isopropylidene glycerine with the code H319, category 2, and label our samples with the pictogram GHS07 and the signal word “warning”. For additional information on the safe handling and the toxicity of the product, consult the Material Safety Data Sheet.

GLACON
GREEN
CHEMISTRY

GLACONCHEMIE will produce GLYCASOL® / Isopropylidene glycerine exclusively from biogenous glycerine originated from vegetable oils. The proportion of biogenous material in the finished product GLYCASOL® will be 68.2 %.

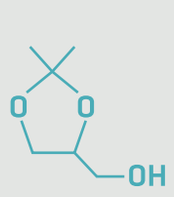
TECHNICAL INFORMATION GLYCASOL® / 2,3-O-ISOPROPYLIDEN GLYCERIN

SYNONYMS

I 2,2-Dimethyl-1,3-dioxolane-4-methanol (4-Hydroxymethyl-2,2-dimethyl-1,3-dioxolane) [approx. 98,5 %]
II 2,2-Dimethyl-1,3-dioxane-5-ol [approx.1,5 %]
(mixture of isomers)

At room temperature isopropylidene glycerine (also referred to as Solketal) is a clear, colourless, practically odourless, mobile liquid. As a by-product of the main component 2,3-O-isopropylidene glycerine the structural isomer II is present in very small amounts:

STRUCTURAL FORMULA $C_6H_{12}O_3$



I

approx. 98,5%

II

approx. 1,5%

TYPICAL PROPERTIES

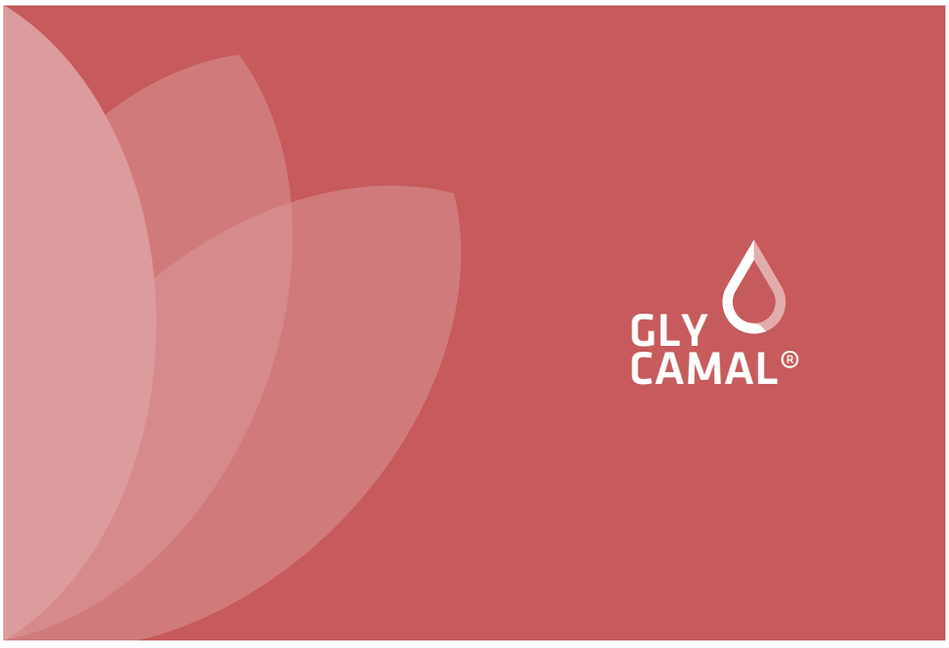
Colour		colourless
Isopropylidene glycerine	wt%	98,5
Glycerine	wt%	1,0
Water	wt%	< 0,5
pH-value (20 °C)		7,2
Viscosity (25 °C))	mPa.s	11

PHYSICAL PROPERTIES

Molecular weight		132,16
Boiling range		188-191°C
Vapour pressure (20 °C)	mbar	< 0,25
Flash point		80°C
Density (20 °C)		1,066g/cm³
Refractive index (20 °C)		1,4309
Conductivity	(20-100 °C) µS/cm	~ 1,02
Surface tension	(25 °C) mN/m	32,10
Hydroxyl value (OH-value)		403
Hydroxyl value (calculated)		424

REGULATORY INFORMATION

CAS	100-79-8
EINECS	202-888-7
INCI Name	Isopropylideneglycerol
REACH	registriert unter EC / List-No. 202-888-7



GLACON
GLYCERINDERIVATE

GLY CAMAL®

GYCAMAL® and its application

Glycerol formal is a monovalent alcohol, linked with a cyclic ether group.

Owing to these two chemical groups of different polarity the molecule shows high affinity to polar as well as to less polar or even up to non-polar substances. As an outstanding property in this sense the complete miscibility with water may be mentioned. For these reasons glycerol formal is especially qualified for the use as solvent for very miscellaneous applications.

The most important industrial applications will be found in colours and varnishes, printing inks, adhesives, pesticides, detergents and cleaning agents or metal cleaners. But beside its function as a plain solvent glycerol formal can exhibit discrete lacquer-forming properties like retardation of drying or film formation.

Glycerol formal is being used for years by pharmacists and veterinarians particularly as carrier or enhancer for active ingredients. The alcoholic hydroxyl functionality of the molecule allows for the participation as building block in many reactions. Within condensation reactions causing the release of water glycerol formal is being incorporated into polyesters, polyurethanes, polyacrylates, polyethers et cetera, accompanied by very distinct modification of their properties. The reaction with anhydrides and acids will yield esters. Results of our lab experiments addressing the characterisation of this substance are available on request.

Toxicity and safety

According to GHS we have classified Glycerol formal with the codes H319 and H361, both category 2, and label our samples with the pictograms GHS07 and GHS8 as well as with the signal word “warning”. For additional information on the safe handling and toxicity of the product, consult the Material Safety Data Sheet.

GLACON
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GLACONCHEMIE will produce GLYCAMAL® / Glycerol formal exclusively from biogenous glycerine originated from vegetable oils. The proportion of biogenous material in the finished product GLYCAMAL® will be 86.6 %.

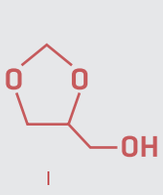
TECHNICAL INFORMATION GLYMAL® | GLYCEROL FORMAL

SYNONYMS

I 1,3-Dioxolane-4-methanol (4-Hydroxymethyl-1,3-dioxolane) [40-50%]
II 1,3-Dioxane-5-ol [50-60%] (Mixture of isomers)

At room temperature glycerol formal is a clear, colourless, practically odourless, mobile liquid. It consists of two structural isomers:

MOLECULAR FORMULA $C_4H_8O_3$



I

approx. 45%

II

approx. 55%

TYPICAL PROPERTIES

Colour		colourless
Glycerol formal	wt%	99,5
Glycerine	wt%	< 0,4
Water	wt%	0,2
Aldehyde	ppm	< 200
pH-value (20 °C)		6,4
Viscosity (25 °C)		mPa.s 14

PHYSICAL PROPERTIES

Molecular weight		104,1
Boiling range		191-195 °C
Vapour pressure (20 °C)	mbar	< 0,24
Flash point		97 °C
Density (20 °C)		1,219 g/cm³
Refractive index (20 °C)		1,4489
Leitfähigkeit (20-100 °C)	µS/cm	1,69-2,70
Surface tension (25 °C)	mN/m	44,51
Hydroxyl value (OH-value)		511
Hydroxyl value (calculated)		539

REGULATORY INFORMATION

CAS	5464-28-8 4740-78-7
EINECS	226-758-4 225-248-9
INCI Name	Glycerol Formal
REACH:	full-registration under EC / List-No. 911-694-8