Enhanced solubility through API processing

Focus on commercialization, not solubilization.

SAFC®

Pharma & Biopharma Raw Material Solutions

Addressing solubility from the beginning

Development of new active pharmaceutical ingredients (APIs) is lengthy and cost-intensive, thus avoiding any potential risk that may limit the product's success is of utmost importance. Today, many APIs are not being commercialized as they are poorly water soluble (BCS class II and IV) and, as a result, exhibit too low bioavailability. With an estimated share of 70 – 80 % of drugs currently under development being poorly water soluble, finding adequate solutions to address this challenge becomes more and more important.

Solubility can be addressed by sophisticated pharmaceutical formulations. But why start optimizing API solubility at a late stage when you can truly enhance your API's performance from the beginning?

API processing can be a means to improve drug solubility without the need to start API development from scratch again. Diverse techniques have evolved and are available to be chosen from according to your specific API's characteristics and needs. We provide you with the high-quality chemical raw materials required for these techniques – so that you can care about commercialization, not solubilization.

High-Quality Raw Materials for Consistent, Safe and Efficient Processes

We offer easy access to an extensive portfolio of high-quality raw materials that are easy to use, ensure product and patient safety and meet your drug development and manufacturing needs.

Find out which techniques exist to improve your API's

- **Solubility**
- **Processability**
- **Physical and chemical stability**
- **Safety**
- **Taste masking**

Salt Formation

Salt formation is a well-established technique, aiming at ionizing the API with the aid of a counterion to improve its physicochemical properties. While increasing solubility is the most prominent reason for forming an API salt, also other parameters like stability, processability, and chemical purity can be positively influenced by this process. More than 50 % of all marketed drugs are currently in salt form, still with increasing trend. Finding the best API-counterion combination is critical for salt formation, therefore we offer a number of high-quality chemicals suitable for the use as counterion to help you avoid drawbacks and maximize your success.

Article No.	Product Name
137000	Acetic acid (glacial) 100 % EMPROVE® EXPERT Ph Eur, BP, JP, USP
100090	Adipic acid EMPROVE® ESSENTIAL Ph Eur, NF
103893	Benzenesulfonic acid EMPROVE® EXPERT
100130	Benzoic acid powder, EMPROVE® ESSENTIAL Ph Eur, BP, USP, E 210
100160	Boric acid cryst., EMPROVE® ESSENTIAL Ph Eur, BP, NF
137002	Citric acid anhydrous powder EMPROVE® EXPERT Ph Eur, BP, ChP, JP, USP
100263	Formic acid 98 – 100 % EMPROVE® ESSENTIAL Ph Eur
817073	Fumaric acid EMPROVE® ESSENTIAL ChP, NF, JPE
100286	L-Glutamine EMPROVE® ESSENTIAL DAB, USP
137007	Hydrochloric acid fuming 37 % EMPROVE® EXPERT Ph Eur, BP, JP, NF, ACS
137098	Imidazole EMPROVE® EXPERT ACS
100366	(S)-Lactic acid about 90 % EMPROVE® EXPERT Ph Eur, BP, E 270
817058	Maleic acid EMPROVE® ESSENTIAL Ph Eur, NF
100383	DL-Malic acid EMPROVE® ESSENTIAL Ph Eur, NF, FCC, E 296
100563	ortho-Phosphoric acid 85 % EMPROVE® ESSENTIAL Ph Eur, BP, JPE, NF, E 338
100631	Salicylic acid EMPROVE® ESSENTIAL Ph Eur, BP, USP
100662	Sorbic acid EMPROVE® ESSENTIAL Ph Eur, BP, NF, FCC, E 200
100681	Succinic acid cryst., EMPROVE® ESSENTIAL ChP, NF, JPE, ACS
100713	Sulfuric acid 95 – 98 % EMPROVE® ESSENTIAL Ph Eur, BP, JPE, NF
100803	L(+)-Tartaric acid powder EMPROVE® ESSENTIAL Ph Eur, BP, JP, NF, E 334

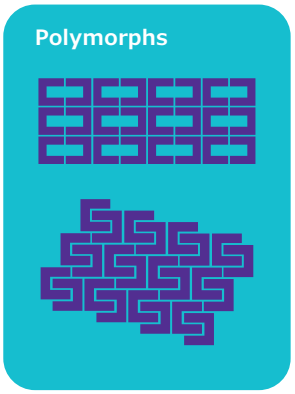
Cocrystal Formation

Cocrystals can be an alternative to salts, especially if the API is non-ionizable. Unlike salts, API and co-former interact here by non-ionic forces, like hydrogen bonding, van der Waals forces and others, to build a joint crystal lattice. Cocrystals avoid diverse downsides that come along with salts, while offering the same benefits such as improved solubility, stability, processability, and chemical purity. Nearly every API can form a cocrystal if a suitable co-former is used, therefore finding the right co-former and in sufficient quality is key. We provide a set of high-quality chemicals suitable for cocrystal formation with a broad range of APIs.

Article No.	Product Name
100090	Adipic acid EMPROVE® ESSENTIAL Ph Eur, NF
103893	Benzenesulfonic acid EMPROVE® EXPERT
100130	Benzoic acid powder, EMPROVE® ESSENTIAL Ph Eur, BP, USP, E 210
100160	Boric acid cryst., EMPROVE® ESSENTIAL Ph Eur, BP, JP, NF
102584	Caffeine EMPROVE® ESSENTIAL Ph Eur, BP, USP
137002	Citric acid anhydrous powder EMPROVE® EXPERT Ph Eur, BP, ChP, JP, USP
817073	Fumaric acid EMPROVE® ESSENTIAL ChP, NF, JPE
100286	L-Glutamine EMPROVE® ESSENTIAL DAB, USP
110110	HEPES EMPROVE® EXPERT
104352	L-Histidine EMPROVE® EXPERT Ph Eur, ChP, JP, USP
137098	Imidazole EMPROVE® EXPERT ACS
100366	(S)-Lactic acid about 90 % EMPROVE® EXPERT Ph Eur, BP, E 270
817058	Maleic acid EMPROVE® ESSENTIAL Ph Eur, NF
100383	DL-Malic acid EMPROVE® ESSENTIAL Ph Eur, NF, FCC, E 296
106757	Methyl 4-hydroxybenzoate EMPROVE® ESSENTIAL Ph Eur, BP, JP, NF
500299	Nicotinamide EMPROVE® ESSENTIAL Ph Eur, BP, USP, JP, FCC
100201	Phenol EMPROVE® ESSENTIAL Ph Eur, ChP, JP, USP
107427	Propyl 4-hydroxybenzoate EMPROVE® ESSENTIAL Ph Eur, BP, JP, NF
100631	Salicylic acid EMPROVE® ESSENTIAL Ph Eur, BP, USP
100662	Sorbic acid EMPROVE® ESSENTIAL Ph Eur, BP, NF, FCC, E 200
100681	Succinic acid cryst., EMPROVE® ESSENTIAL ChP, NF, JPE, ACS
100803	L(+)-Tartaric acid powder EMPROVE® ESSENTIAL Ph Eur, BP, JP, NF, E 334
137148	Triethanolamine EMPROVE® EXPERT, Ph Eur, NF
137030	Urea cryst. EMPROVE® EXPERT Ph Eur, BP, JP, USP, ACS
108510	Vanillin EMPROVE® ESSENTIAL Ph Eur, BP, NF

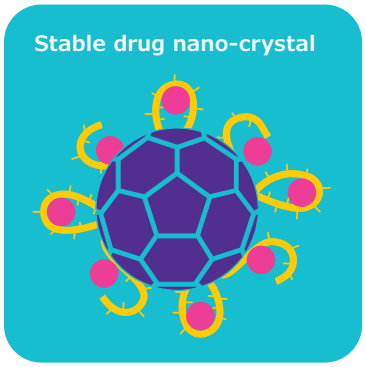
Polymorph Screening

Polymorphism of APIs describes the fact that the respective compound can exist in different crystalline forms. Each polymorph has distinct pharmaceutical characteristics, hence influencing solubility, activity, and safety of the drug substance. Identifying the polymorph with the most suitable properties is a key element of early drug development. Via techniques like crystallization through solvent evaporation, antisolvent crystallization, slurrying and others, different forms of polymorphs can be screened and identified. We provide the respective raw materials needed for the application of these techniques.



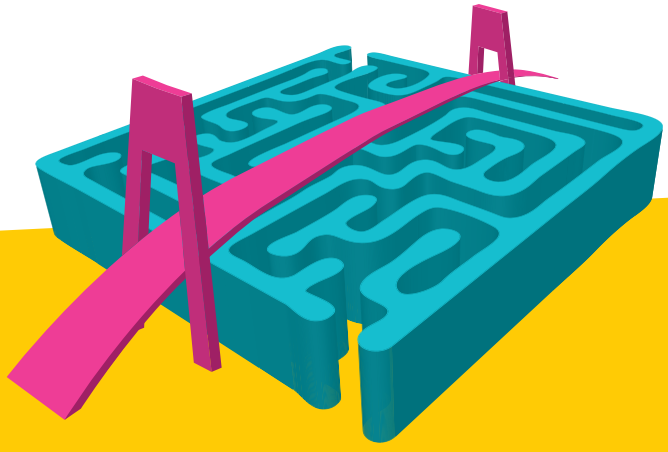
Article No.	Product Name
100056	Acetic acid (glacial) 100 % EMPROVE® ESSENTIAL Ph Eur, BP, JP, USP, E 260
100013	Acetone EMPROVE® ESSENTIAL Ph Eur, BP, JPE, NF
137134	Acetonitrile EMPROVE® ESSENTIAL
100988	1-Butanol EMPROVE® ESSENTIAL NF
102431	Chloroform EMPROVE® ESSENTIAL
106049	Dichloromethane EMPROVE® ESSENTIAL Ph Eur, BP, NF
100926	Diethyl ether EMPROVE® ESSENTIAL Ph Eur, BP
137117	Dimethyl Sulfoxide EMPROVE® EXPERT Ph Eur, USP
100986	Ethanol absolute EMPROVE® EXPERT Ph Eur, BP, ChP, JP, USP
100864	Ethyl acetate EMPROVE® ESSENTIAL Ph Eur, BP, NF
100263	Formic acid 98 – 100 % EMPROVE® ESSENTIAL Ph Eur
106008	Methanol EMPROVE® ESSENTIAL Ph Eur, BP, JPE, NF
100995	2-Propanol EMPROVE® ESSENTIAL Ph Eur, BP, ChP, JP, USP
137136	Tetrahydrofuran EMPROVE® ESSENTIAL

Nano-Milling



API nano-milling has gained significant importance as a technique to reduce particle size, which strongly increases the drug surface area and, as a result, drug solubility. Avoiding re-aggregation events during and after processing is key to maintain small particle size and solubility improvements, therefore stabilizers are needed. Two mechanisms contribute to stabilization: steric stabilization, which can be achieved by adding nonionic polymers and nonionic surfactants, and electrostatic stabilization, which can be achieved by adding ionic surfactants. Dependent on the respective API, combinations of the above can be an option for enhancing long-term stability. Our broad portfolio includes diverse polymers and surfactants meeting your specific needs and supporting nano-crystal stability.

Article No.	Product Name
137112	Poloxamer 188 EMPROVE® EXPERT (stabilized with 70 ppm BHT) Ph Eur, NF
817005	Polyethylene glycol 1500 (scales) EMPROVE® ESSENTIAL Ph Eur
817019	Polyethylene glycol 3000 EMPROVE® ESSENTIAL Ph Eur
817006	Polyethylene glycol 4000 (powder) EMPROVE® ESSENTIAL Ph Eur
817007	Polyethylene glycol 6000 EMPROVE® ESSENTIAL Ph Eur
817018	Polyethylene glycol 20000 EMPROVE® ESSENTIAL Ph Eur
141350	Polyvinyl alcohol 4-88 EMPROVE® ESSENTIAL Ph Eur, ChP, USP, JPE
141355	Polyvinyl alcohol 18-88 EMPROVE® ESSENTIAL Ph Eur, ChP, USP, JPE
141352	Polyvinyl alcohol 26-88 EMPROVE® ESSENTIAL Ph Eur, USP, JPE
141356	Polyvinyl alcohol 28-99 EMPROVE® ESSENTIAL Ph Eur, JPE
141353	Polyvinyl alcohol 40-88 EMPROVE® ESSENTIAL Ph Eur, ChP, USP, JPE
817034	Sodium dodecyl sulfate EMPROVE® ESSENTIAL Ph Eur
817072	Tween® 20 (Polysorbate) EMPROVE® ESSENTIAL Ph Eur, JPE, NF
817076	Tween® 60 (Polysorbate) EMPROVE® ESSENTIAL Ph Eur, JPE, NF
817061	Tween® 80 (Polysorbate) EMPROVE® ESSENTIAL Ph Eur, JP, NF



The Emprove® Program

Your fast track through regulatory challenges.

Ensuring the compliance of your pharma and biopharma products involves the compilation of a vast amount of data, which can be time and resource intensive. Our Emprove® Program provides comprehensive and up-to-date documentation to help you navigate regulatory challenges, manage risks, and improve your manufacturing processes.

Our Emprove® Chemicals portfolio contains over 400 pharmaceutical raw and starting materials. To address different levels of risk, and to simplify and streamline the selection process, the portfolio is divided into four categories: Emprove® Evolve, Essential, Expert and API. The Emprove® Expert category addresses higher risk applications where the lowest microbiological and endotoxin levels are of utmost importance.

The Emprove® Program also covers filter and single-use components, as well as selected chromatography resins and cell culture media. Each product portfolio is supported with Emprove® Dossiers.

Find out more at:
SigmaAldrich.com/emprove

Interested in formulation optimization?

In addition to enhancing the solubility of the API itself through API processing, it is of course possible to (further) improve solubility by optimizing the formulation.

Explore our broad range of products covering solid, semi-solid, and liquid dosage forms for small and large molecules. Enhance solubility using our functional excipients, for example excipients specifically developed for hot-melt extrusion, dissolution rate enhancement, our silica drug carrier, cyclodextrin and meglumine – all backed by stringent quality control and regulatory support.

For more information, visit:
SigmaAldrich.com/formulation

Formulation Product Finder App

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