



H₂O & DMSO Solubility

Key Capabilities

QUANTUM software predicts both aqueous and dimethyl sulfoxide (DMSO) solubility of organic compounds at various temperatures and pH values (from 0.0 to 14.0). The accuracy of calculations is better 1.0 of logS units. Such parameters as the solvent temperature, pH and ion strength are adjustable. The results of the calculations are represented both in logarithmic (LogS) and absolute (g/l) units.

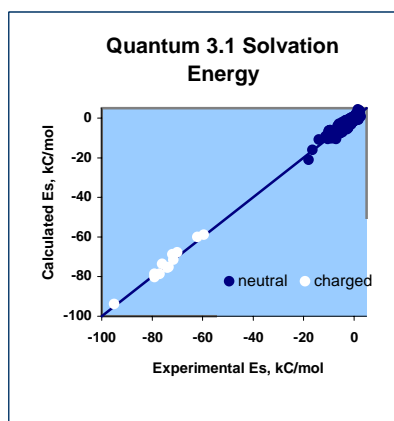
Technological Advantage

The main advantage of QUANTUM is the quality of underlying physical models. Most of competing approaches use different kinds of fragment based descriptors to calculate the molecular properties from known properties of similar compounds (QSAR). Such models rely heavily on additivity of molecular properties, are often overparametrized and lack direct physical justification. As a result, the prediction power of the models may be very good for structures similar to those used in the training set and may not be sufficient for absolutely novel compounds. QUANTUM derives molecular properties from first principles based models directly using advanced quantum mechanical analysis of molecular interactions and thermodynamics.

QUANTUM LogS calculations (QLogS)

The quality of solubility prediction depends on the two major components: the solvation free energy and crystal disruption thermodynamics calculations. The figure below demonstrates the correlation between experimental and calculated values of the solvation free energies for more

than 300 organic molecules and ions.

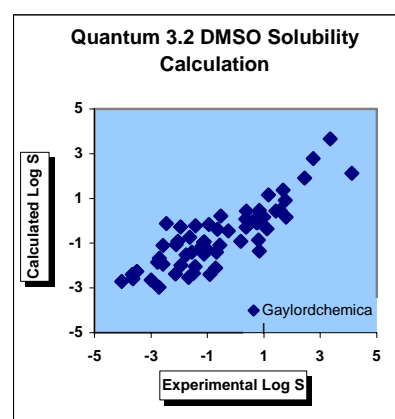
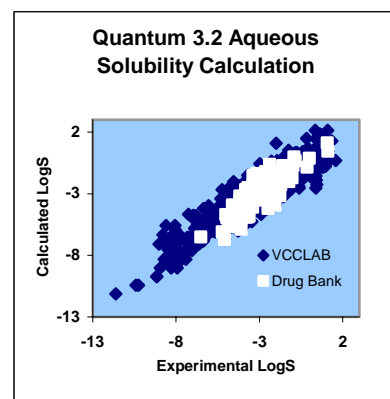


QlogS software uses QUANTUM Mechanics to calculate electronic densities of the molecules in aqueous environment. The surrounding water molecules are simulated with the help of our continuous solvation model. The model provides a good approximation both for the short and the long range water electrostatics, as well as for the short-range non-polar forces (hydrophobic effect).

As of now Quantum Pharmaceuticals possesses validated continuous solvation models for the following three important solvents: water, octanol, and DMSO. The first two are employed in our *logP* calculations.

Accurate prediction of the solvation free energy together with a simple crystal disruption model allows

calculation of the solubility of organic molecules both in water and DMSO.



The calculations are presented for more than 1,300 and 60 compounds for aqueous and DMSO solubility examples, respectively. The white points on the aqueous solubility graph represent the *LogS* values calculated for a number of commercially available drugs taken

from [Drug Bank database](#), whereas the blue points show QUANTUM performance for a set of generic molecules taken from [Virtual Computational Chemistry Lab](#) [6]. The points on the DMSO solubility graph represent the *LogS* values calculated for a number of chemicals taken from [Gaylord Chemical Corporation database](#). Root mean squared error is 0.81 and 1.0 logarithmic units for water and DMSO calculations.

Note that in the temperature range 20-25C the experimental values of *logS* are characterized by standard deviation of approx. 0.6 (see discussion in e.g. [6]). This means that QUANTUM calculations give the logarithmic solubility *logS* with accuracy comparable to that of chemical experiments.

Software Discription

The software runs both under Windows XP and Linux OSes (see technical requirements below). Users can either import structures in any popular third-party formats or design a molecule using an array of build in tools. QUANTUM software includes user friendly chemical drawing utility.

The software can process multiple molecules (compounds library) either from a multi-molecular file or from a folder on the file system. All the calculated properties and the optimized structures can be exported for further references. QUANTUM software does not require molecules in a three dimensional format or optimized to minimum energy geometry. The necessary conformation is obtained in the course of the *LogS* calculation.

The software calculates both aqueous and DMSO solubility in logarithmic units, *logS*, as well as the solubility in absolute units (g/l).

The key features of the software are summarized in the following table:

Import from .mol file	✓
Import from .hin file	✓
Import from .pdb file	✓
Import from .sdf file	✓
Import from SMILES text file	✓
<i>LogS</i> , at a given pH	✓
Automatical calculation <i>logS</i> values for an unlimited number of compounds at once	✓

QlogS software lets users search and select compounds within desired ranges of calculated properties and export such molecular libraries in any of the listed file formats (multi-molecular files or folders).

TRY IT FREE ONLINE

You can easily see how our QlogS works. Upload a small molecule with possibly a known *logS* value and calculate QlogS instantly on our web-site (<http://q-lead.com>)

Web-Based Solutions

Web services provide a possibility to order a service rather than own the software. We let our users to submit a customer's library of compounds through the web interface (in one of the commonly used formats such as .sdf, .mol2, .hin or .pdb) and obtain the results of the calculations shortly. Full confidentiality and customer's IP protection are guaranteed.

The online version of the QlogS software has most of the functionality of the stand-alone version.

Software/Hardware Requirements

Linux:

Linux-32/64-bit Intel compatible CPU, glibc >2.3 Glibc 2.3 Python 2.4 wxPython 2.6;

Windows:

Windows 2000, Windows XP

Hardware:

Processor: Intel P4 or higher, AMD Athlon 64 (with SSE support) or higher Memory: at least 1 GB RAM Disk Space: 1 GB

References:

- 1) A. Vinnik, *Russia Quantum Lead Computational Technology for Drug Discovery*, in proc. of International Symposium on "Recent Trends in Drug Discovery", 8 - 10th January, 2005, Gujarat, India
- 2) V. Kartsev, *Russia Novel Approaches in Drug Discovery R&D*, in proc. of International Symposium on "Recent Trends in Drug Discovery" On 8 - 10th January, 2005, Gujarat, India
- 3) P. Fedichev, L. Men'shikov, *Long-Range Interactions of Macroscopic Objects in Polar Liquids*, [ArXiv:cond-mat/0601129.pdf](#), submitted for publication.
- 4) P. Fedichev, *Discovery of novel drug candidates by using the new methods of molecular modeling*, in proc. of Russian Section of the QSAR and Modeling Society's, Feb 2006 (Moscow, Russia)
- 5) P. Fedichev, *Beyond Scoring Functions: Fast First-Principles Quantum and Molecular Physics Tools for Structure-Based Drug Design*, in proc. of Structure Based Drug Design, [Cambridge Healthtech Institute's 6th annual conference](#), June 15-16, 2006.
- 6) K.V. Balakin, N.P. Savchuk and I.V. Tetko. *In Silico Approaches to Prediction of Aqueous and DMSO Solubility of Drug-Like Compounds: Trends, Problems, and Solutions*, *Curr. Medicinal Chemistry*. **13**, 223-241 (2006).

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