

Using the available pK_a data in non-aqueous solvents

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The acid and base strengths, typically expressed as pK_a values, depend on solvation of the proton, as well as of the neutral and ionized forms of the acid/base.¹ Every solvent has different solvation properties. Thus, the pK_a values for the same acid/base in different solvents are also different (often dramatically different). In principle, whenever using pK_a values for predicting or rationalizing chemical processes, the pK_a values determined in the same solvent should be used. In some solvents, e.g. water, DMSO or acetonitrile large bodies of pK_a data exist, while in most solvents either very few pK_a values are available or none at all. This leads to the frequent need of estimating pK_a values in one solvent from the data in other solvent(s).^{2,3} An additional consideration is the (often problematic) quality of pK_a data in the literature.

When estimating pK_a values in one solvent based on the data in another solvent it is important to clearly define the aim. Is it needed to have the absolute pK_a value or is it rather necessary to have the acidity/basicity differences (or acidity/basicity order) within a set of compounds? Perhaps the question is just "can base B deprotonate acid A in solvent S"? If absolute pK_a value is needed then what accuracy is necessary? This presentation gives an overview to what extent such estimates can be usefully done, highlighting both successes and failures,¹ as well as how to recognize clearly erroneous pK_a data.

- (1) Kütt, A.; Selberg, S.; Kaljurand, I.; Tshepelevitsh, S.; Heering, A.; Darnell, A.; Kaupmees, K.; Piirsalu, M.; Leito, I. pK_a Values in Organic Chemistry – Making Maximum Use of the Available Data. *Tetrahedron Letters* **2018**, *59* (42), 3738–3748. <https://doi.org/10.1016/j.tetlet.2018.08.054>.
- (2) Kütt, A.; Tshepelevitsh, S.; Saame, J.; Lõkov, M.; Kaljurand, I.; Selberg, S.; Leito, I. Strengths of Acids in Acetonitrile. *Eur. J. Org. Chem.* **2021**, *2021* (9), 1407–1419. <https://doi.org/10.1002/ejoc.202001649>.
- (3) Tshepelevitsh, S.; Kütt, A.; Lõkov, M.; Kaljurand, I.; Saame, J.; Heering, A.; Plieger, P. G.; Vianello, R.; Leito, I. On the Basicity of Organic Bases in Different Media: On the Basicity of Organic Bases in Different Media. *Eur. J. Org. Chem.* **2019**, *2019* (40), 6735–6748. <https://doi.org/10.1002/ejoc.201900956>.