

# Green Solvents–Progress in science and application

DOI: 10.1039/b907013n

The use of organic solvents remains a major source for VOC emissions from the chemical industry. As shown in Fig. 1, VOC emissions in Germany were cut down by almost 50% percent within the period of 1990 to 2000. However, the reduction was mainly achieved within the transportation and fuel sector, whereas the total emission from solvent uses remained almost stagnant at approximately 1000 kT per year. This reflects at least partly the fact that emission can be controlled in transportation by increased engine efficiency and other technical measures, but reduction requires replacement of existing solvent technologies in the processing sector. The implementation of Green Solvents thus has still a large potential to contribute to more sustainable processes in chemical, pharmaceutical and processing industries.

industrial sectors, as they can lead to improvements and innovations in reaction and processing technologies beyond the replacement of conventional solvents in existing processes. The biennial conference “Green Solvents” focuses on the use of such media in chemical synthesis, catalysis, material sciences, and separation processes. The present issue of *Green Chemistry* features a number of contributions that are based on presentations given at the latest, fourth edition, of this symposium, held in Friedrichshafen at the beautiful shores of Lake Constance, Germany, from 28 September to 2 October 2008. Professor **Istvan Horvath** gave the *Green Chemistry* sponsored lecture at this meeting as part of the celebrations for the 10th year of publishing of the Journal, and a perspective based on the his lecture was published in Issue 11, 2008

- The use of green solvents can provide additional control factors over activity and selectivity in all areas of catalysis, including heterogeneous, homogeneous and bio-catalysis.

- The preparation of catalysts and materials holds many opportunities for the application of advanced fluids.

- The principal requirements of solution phase processes in the utilization and transformation of biomass opens a wide field of enormous potential impact for green solvents in the supply chain of fuels and chemicals.

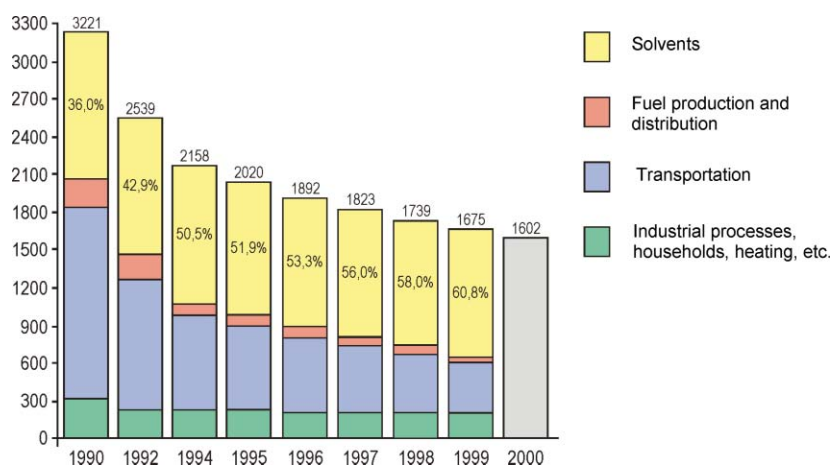
Another interesting aspect that has been prolific in this area over the years is the complementary and synergistic research on chemical processes with other fields of applications requiring fluid phases. Recently, this has been most pronounced for ionic liquids, where applications as diverse as compressor fluids, solar cells, or electroplating are progressing rapidly. As a result, two types of conferences, which are held in alternating years, have emerged: The “Green Solvents” conference, where typical solvent and solution phase processes can be discussed in direct comparison to the concepts based on other advanced fluids, and the “International Conference on Ionic Liquids” (COIL, to be held this year for third time from 31 May–4 June 2009, in Cairns, Australia) where the latest developments on ILs are discussed all across the various areas of applications.

The 2008 edition of the Green Solvents conference was entitled “Progress in Science and Application”. Albeit the meeting showed that significant progress has been made over the last 5–10 years, it also demonstrated that many fundamental questions are yet to be answered and numerous applications are still to be developed. It is thus more than likely, that we will meet again in 2010.

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**Fig. 1** Reduction of VOC emissions from various sources in Germany during the period of 1990 to 2000. (Graphics reproduced from: Umweltdaten Deutschland 2002, www.umweltbundesamt.de.)

The pharmaceutical industry, for example, has made significant steps towards identifying organic solvents with a reduced ecological footprint compared to traditional reaction and separation media (*1st generation green solvents*). *Advanced fluids* or *2nd generation green solvents*, such as water, liquid polymers, ionic liquids, and supercritical fluids, hold considerable additional promise for this and other

(*Green Chem.*, 2008, **10**, 1024–1028, DOI: 10.1039/b812804a).

From the presentations and discussions at this conference several trends can be deduced, which are also reflected in the contributions to this volume.

- The integration of reaction and separation for process intensification continues to be a major driving force for the research in this field.