

NEW ROUTES FOR GREEN SOLVENTS TOWARD INDUSTRIAL APPLICATIONS

The concepts behind green and sustainable chemistry are holistic in nature and aim to protect both the environment and human health from the risks posed by dangerous chemicals and solvents. As a means to further these endeavours, our group has investigated several applications of ionic liquids¹, extractions with butane and fluoro-hydrocarbons as well as NADES (natural deep eutectic solvents) and GVL (γ -valerolactone) over the last decade. Solvent-free processes have also been successfully performed in ball mills² and microwave reactors³. These enabling technologies, together with cavitation reactors (ultrasound and hydrodynamic cavitation), have dramatically changed the way that green chemical processes are designed. We have recently focused our efforts on the use of GVL, a bio-based, dipolar and aprotic solvent that is commonly prepared via the hydrogenation of biomass-derived levulinic acid. We have also reported the microwave-assisted, cascade production of GVL from lignocellulosic biomass which is particularly noteworthy for the fact that GVL is both the process solvent and product⁴. Example applications for this valuable, green alternative to polar solvents will be presented and, wherever possible, comparisons with classic organic solvents will be made.

¹ Calcio Gaudino, E.; Cravotto, G.; Garella, G.; Tagliapietra, S.; Bonrath, W. *Org. Prep. Proc. Int.* **2012**, 44(2), 175-179.

² Jicsinszky, L.; Caporaso, M.; Tuza, K.; Martina, K.; Cravotto, G. *ACS Sust. Chem. Eng.* **2016**, 4(3), 919-929.

³ Garella, D.; Barge, A.; Upadhyaya, D.; Rodríguez, Z.; Cravotto, G. *Synth. Commun.* **2010**, 40(1), 120-128.

⁴ S. Tabasso, G. Grillo, D. Carnaroglio, E. Calcio Gaudino, G. Cravotto, *Molecules*, **2016**, 21, 413.