"Separation challenges in the quest for sustainability"

Needs for separating mixtures are pervasive in many industrial sectors. In past decades the importance escalated with the emergence of new industries in biotechnology and high-performance materials. However, Separation Processes account for 40-70% of both the capital and operating costs in the process industries and are responsible for 10-15% of the world's total energy consumption. This is due in part because of the ubiquity of chemicals in the modern world and in part due to the fact that more than 80% of the energy associated with chemical separations is used in distillation and similar processes such as evaporation that rely on phase changes. Therefore, progress substitution of conventional separation methods by more efficient alternatives is challenging for a more sustainable development.

The drivers for new and more efficient separation alternatives are, i) design of high performance materials (functionalized membranes and nano-structured materials) capable of overcoming equilibrium constraints and increasing the separation selectivity at the same time that keep the productivity target, ii) progressive use of low energy driving forces such as magnetic fields targeting solutes with magnetic properties and, iii) advanced decision-making tools that integrate predictive modeling of separation units and materials function to provide the optimum process configuration that maximizes the profit and the protection of the environment and natural resources.