MICROWAVES IN THE PETROCHEMICAL AND PETROLEUM INDUSTRY

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We have set a new research program aiming at assessing the viability of using microwaves as a processing tool in the industrial sector. This presentation will present our approach to the petroleum and petrochemical industry. Of particular interest is the study of the effects of varying pressures in function of dielectric properties as well as the development of microwave-susceptible catalysts with the view to provide microwave-specific conditions that could not be achieved via conventional processing.

As a continuation of our work in further developing novel MAP technologies, we have looked at applying microwaves under sub- and supercritical fluid conditions. Little work has been done to date to monitor *in situ* the behaviour of materials and the variations in dielectric properties of materials under pressure, yet this could have a major impact on the commercial viability of numerous microwave-assisted industrial processes. Results obtained to date for the extraction of plant material, have resulted in higher yields than conventional SFE, shorter extraction times and significant variations in solubility. Among the main advantages of this MAP approach are its capacity to be able to operate at much lower temperatures and pressures than currently used. Theoretical considerations associated with parameters such as pressure, temperature and density when MAP is carried out using sub- and supercritical fluid will be discussed in terms of microwave coupling efficiency.

An objective if this work is to monitor the influence of pressure over the dielectric behaviour of the materials. The latter is interesting to further see whether pressure could have an impact on the efficiency of applying microwaves to selected materials with the ultimate goal to reduce the overall energy being consumed by a microwave-assisted process. Pressurized carbon dioxide has been the focus of our most recent work because it exhibits a rather peculiar behaviour just before the pressure reaches the critical point. In fact when carbon dioxide is in its liquid form it exhibits a drastic change in density over a relatively modest change in pressure. This is of particular interest because for a constant temperature and volume, it is possible to basically triple the mass of carbon dioxide, thus increase the number of molecules by a factor of three.

From the catalyst standpoint, the target catalysts will offer the possibility of being regenerated *in situ* while exhibiting fast and reproducible heating patterns. The overall objective is selective heating with the view of reducing energy consumption while offering new chemical pathways. This work is based exclusively on the unique selective heating capacity associated with exposure of materials to microwaves.