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EDITOR'S MESSAGE

Microwaves & Green Processing

In 1798 Thomas Robert Malthus wrote the book *An Essay on the Principle of Population* in which he described a relationship between population growth and food production, and in which he stated that when food production is not sufficient to feed the population, it will lead to a catastrophe. Now that world's population is reaching 7 billion, and we have seen food shortages occurring in several places, what is the breaking point in terms of food, water and healthy environment? Moreover, there is another modern hunger; this is the hunger for energy resources. What is the breakpoint for them?

New concerns regarding these breakpoints are appearing daily; scientists and engineers are searching and developing new methods for producing goods and services with using less energy, with less waste and reducing the release of hazardous substances. The goal is to satisfy our current needs while preserving our natural resources for the future generations. The set of activities for achieving this goal is called "sustainability" and given that these processes are often referred as ecological, they are called "green".

The argument regarding energy concerns two aspects; the first one considers sources of energy other than fossil fuels, presented as alternative energies; eolic (wind), solar, hydraulic. The second aspect focuses upon applying technologies with extreme efficiency. There is still something else, "green"; while fossil fuels are targeted because of global warming, "green" is not only for reduction in the generation of CO_2 and other gases, it is also for reduction or elimination of any hazardous substances released to the environment.

Microwave processing covers both "green" aspects. While most of the alternate energies are intended for electricity, microwave processing has great opportunity, since heat is produced within the material, rather than direct burning of fuel with fire. Depending on the material to be processed, microwave devices are themselves part of a technology highly efficient.

Without justifying the meaning of "renewable energy", the use of microwave could lead to cases where efficiency, which is important from an economics point of view, could become secondary from an ecological perspective, since fossil fuels are not used. Moreover, if microwaves can do something else than just heating, then comparison in terms of efficiency is meaningless.

Microwave green processing is not only a claim of researchers, who assumed that microwaves are a clean heating media, able to heat

in vacuum, in several different atmospheres and that energy applied directly into the sample is of higher efficiency. Many papers describe dramatic reduction of reaction times and higher energy efficiency compared to conventional heating methods. These various applications range from recycling or elimination of solvents, reduction of synthesis temperature and time, soil remediation, organic chemistry, and applications in material sciences and nanotechnology.

Applying microwaves to chemical reactions is called "microwave chemistry", which is claimed to be also "green" when it reduces the use of solvents or their release into the environment. But, it is not a cleaning task; it is a means of pollution control.

By linking chemistry and microwaves, in how many of the achievements of chemistry described Ms. Irina Bokova, Director-General of UNESCO, would be microwave processing involved? In her message addressed on the occasion of the launch of the International Year of Chemistry, she declared that "Discoveries in the field of chemistry can help us to meet the challenges of climate change, water management and sustainable development. Most of the twentieth century's therapeutic breakthroughs, food and technological progress were achieved thanks to chemistry. It has revolutionized the manufacture of medicines, clothes and cosmetics, as well as the production, conservation and distribution of energy. However, the applications of chemistry are sometimes dangerous, toxic and polluting. We must face these issues and develop lasting solutions, with all the relevant partners", she also said "We know that green chemistry will play a role at the forefront of the development of alternative energy as well as agriculture to provide for an increasing global population. Without chemistry, there would be no solar panels. Without chemistry, we would not have biofuels. The discoveries of chemistry can help us tackle the challenges of global climate change, and secure access to sources of clean water."

Microwave processing is a technology that is now, and will be in the future, a relevant partner of chemistry and green chemistry, helping mankind to stay safely away of the catastrophic breakpoints.

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